VOL. LXXXV. No. 2194. [All Rights Reserved.] DECEMBER 12, 1919. [Registered at G.P.O. as a Newspaper and Canadian Magazine rate of Postage.] PRICE FOURPENCE.

LONDON: PUBLISHING OFFICE, 4, LUDGATE HILL, E.C.4. SUBSCRIPTION per annum, Postage inclusive in Great Britain, £1 1s. 6d. Canada, £1 8s. 10d. ($5.80); to all other countries, 30s.—NEW YORK: D. VAN NOSTRAND CO., 25, Park Place, New York City. TORONTO, CAN.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, Librairie, Etrangère, 22, Rue de la Banque.
Telegraphic Address: "Ageokay, Cent., London." A B C Code. Telephone Nos. City 997; Central 4425 (Editorial only).

LITHOLITE INSULATORS, Ltd.
65—67, Hackney Grove, London, E. 8.
'Phone and Telegrams: Dalston 692, London.
FIREPROOF AND OTHER GRADES.
ESTABLISHED NEARLY 20 YEARS.

SILUMINITE.
Fireproof—Non-Hygroscopic—High Resistant.
The new low priced British Insulating Material having qualities and characteristics possessed by no other Insulating Material. Used by the Government and leading Railways and Electrical Firms.
THE SILUMINITE INSULATOR CO., Ltd.,
The Green, Southall, Middlesex.
'Phone: Southall 89 See Large Advt. every alternate week.

T. H. FERGUSON, PAILIN, LIMITED, A. C.
SWITCHBOARDS.
L. T. EDWARD ST., Hr. Openshaw, MANCHESTER. Tel.: 330 Openshaw. D. C.

INSTRUMENTS, CIRCUIT-BREAKERS,
AUTO-CUT-IN & CUT-OUTS.
The Record Electrical Co., Ltd.
BROADHEATH, MANCHESTER.
TELEPHONE: 164 ALTRINCHAM.

BROOK
ONE, TWO and THREE-PHASE
MOTORS.
See Sup. 46.

SWITCHGEAR.
ERNEST F. MOY, LTD.,
Manufacturing Electrical Engineers and Government Contractors,
GREENLAND PLACE, CAMDEN TOWN, LONDON.

NEW DISTRIBUTION BOXES.
THE CANTIE PATENT FUSE WILL CLEAR A "DEAD SHORT."
ALL CONNECTIONS FROM FRONT
THE CANTIE SWITCH CO., LTD.,
67, MOUNT ST., NOTTINGHAM.

SAXONIA
ELECTRICAL WIRE CO., LTD.,
ALWAYS GREENWICH, S.E.
ALL BRITISH
FLEXIBLE CABLES.

CHURTON
SINGLE and POLYPHASE
MOTORS.
T. HARDING CHURTON & CO., LTD.,
Atlas Works, Water Lane, LEEDS.

SKATOSKALO BOILER SCALING TOOLS.
Sole Maker:
FRANK GILMAN,
9, Westfield Road, BIRMINGHAM.
See Advertisement last week, page xxxvii.

"EMPIRE" AUTOMATIC CONTROL
FOR
Pumps, Compressors, Machine Tools.
ELECTRIC CONTROL, LIMITED, GLASGOW.

WESTERN-ELECTRIC
COMPANY, LIMITED,
Norfolk House, Victoria Embankment, W.C.2
Works: NORTH WOOLWICH, LONDON, E.
TELEPHONES & CABLES.
See Advertisement this week, Sup. 4.

CONNOLLY'S (BLACKLEY), LD.,
for
WIRES AND CABLES.
See Advertisement last week, p. iii.

STEEPLEJACKS
— Chimneys Raised, Felled, —
Straightened, Pointed and Banded.
The CHIMNEY CONSTRUCTION and BOILER SETTING Co., Ltd.,
7, Princes Street, Westminster, S.W. 1.
Telephone: Victoria 6607. Telegrams: Chimbocsta, Phone, London.

LABELS & BADGES.
Name Plates, Meter Dials, Switchboard Labels, Address and Instruction Plates, Advertising Novelties, Club Badges, Checks, Tokens, Blanks, Die Stampings, Dies, Press Tools, Punches and Cutters.
RELIANCE Engraving Co., Ltd., CHISWICK.

JULIUS SAX
FOR
ACCESSORIES.
Over 50 years' experience.

YOUR PROBLEMS— AND OUR SOLUTION.
See page xv.

Glasgow Office: 69, Gordon St.
OPENSHAW, DYNAMOS **ELECTROMOTORS, Ltd.** MOTORS MANCHESTER.
London Office: 49, Queen Victoria St., E.C. 4.

Makers of— **FULLER,**
WIRES & CABLES,
ACCUMULATORS,
BATTERIES,
CARBONS.
CHADWELL HEATH, ESSEX.

MAVOR & COULSON, Ltd.,
GLASGOW.
MOTORS, DYNAMOS, SWITCHGEAR.

THE BRITISH
ALUMINIUM
COMPANY, LD.,
109, Queen Victoria St.,
See large Advt. 2/12/19. LONDON, E.C. 4.

THERMIT, LIMITED,
(Proprietors: NOBEL'S EXPLOSIVES CO., LTD., GLASGOW.
675, Commercial Road,
LONDON, E. 14.
'Phone: EAST 4157. 'Grams: "FULMEN, PHONE LONDON."

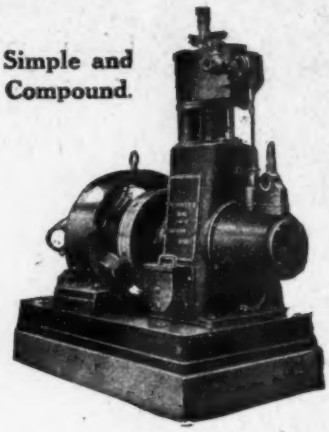
Continuous Control of Coal Consumption
by means of the
LEA COAL METER
for Chain Grate Stokers.
LEA RECORDER Co., Ltd., 28, Deansgate, Manchester.

"M. E. M."
Ironclad Switch and Fuse Gear is both Simple and Efficient. Write us.
MIDLAND ELEC. MFG. CO., LTD.,
BARFORD STREET, - - BIRMINGHAM.

Advertisement Index, see page xxxvi.

VERTICAL ENCLOSED HIGH SPEED STEAM ENGINES.

Simple and Compound.



For Direct Coupling to Dynamos, Fans, Pumps, &c.

For Ship Lighting and Industrial Works of all kinds.

E. S. HINDLEY & SONS,

11, Queen Victoria Street, E.C. 4.

Works: BOURTON, DORSET. Telephone: City 9804. Telegrams: "Steamport, Cannon."

TUDOR ACCUMULATORS

CAN BE OBTAINED

ONLY FROM

THE

TUDOR ACCUMULATOR COMPANY, LIMITED,

3, Central Buildings, WESTMINSTER, S.W. 1.

Telegrams: "SUBCONICAL, LONDON." Telephone: VICTORIA 816.

Works: DUKINFIELD, near MANCHESTER

MICA & MICANITE

INSULATORS FOR EVERY DESCRIPTION OF ELECTRICAL WORK.
Contractors for Air Board, War Office and Admiralty Requirements.
CUTTING AND GAUGING OUR SPECIALITY.
BEST QUALITY MICA ONLY.

'PHONE 4575 CENTRAL.
TELEGRAMS—"MICAYLOR, LONDON."

TAYLOR & PETTERS, LTD.,

40, HATTON GARDEN,
LONDON, E.C. 1.
(The Oldest Established Mica House in the country.)
AND ALL BRITISH.

BUYERS OF SCRAP METAL LTD.

GLYN STREET, VAUXHALL, LONDON S.E.11.

Telephone: HOP 4520

Offer your stocks — state full description and quantity Terms of Purchase — Prompt cash against delivery - - - - -

Telegrams: "SCRABVAU" LONDON

Telephone: CITY 3115.

Contractors to H.M. Government.

Telegrams: "VANDUARA, CENT. LONDON."

ELECTRICAL INSULATING TAPES, WEBS, CORDS, SLEEVING, &c.

DELIVERY FROM STOCK.

JOHN MACLENNAN & CO.,

30, NEWGATE STREET, LONDON, E.C. 1, AND AT 166, INGRAM STREET, GLASGOW.

RS
TOR
S.W. 1.
TORIA 816.
ESTER
E.C.1.
&C.

Ve
The
Lon
Coil
The
Tra
The
(
Cor
The
Wag
Leg
Bus
Not
Rev
City
Stoc
The
K
New
Carb
A
The
New
New
Abst
Cont

Bur
nica
of
fro
con
gra
relu
ning
cop
scri
A
sub

UNI
COL

TE

The
by

ADEL
Gre
AUCK
Alb
Box
BRIS
CHRI
Got
DUNE
Pri
JOHA
FON
BEC
Ltd
LAU
Cit
MELB
lian
Str
Che
THE
Bank

THE

ELECTRICAL REVIEW.

VOL. LXXXV. DECEMBER 12, 1919. No. 2,194.

ELECTRICAL REVIEW.

Vol. LXXXV.] CONTENTS: December 12, 1919. [No. 2,194.

	Page
The Electricity Supply Bill	737
London Wiremen's Wages	739
Coil v. Magneto Ignition, by A. C. Booth (*illus.*)	740
The Sheringham Daylight, by H. D. T. (*illus.*)	741
Trade Statistics of Egypt	742
The Roads and Transport Congress and Exhibition (*illus.*) (*concluded*)	742
Correspondence—	
The Speeding-up of an Induction Motor.—Third Harmonics.—Patent Office Library.—Electric Power Supply to Works.—The Lay-out of Switchgear	743
The New Standards for Cables.—Heating of Induction Motor	744
The "Ni-Fe" Accumulator (*illus.*)	744
Wages in the Electrical Contracting Industry	745
Legal	746
Business Notes	746
Notes	753
Reviews	756
City Notes	758
Stocks and Shares	760
The "Fuel of the Future" and the Gas Companies, by B. L. Klemens	761
New Electrical Proposals for Parliament to Consider ...	762
Carbon Arcs for Searchlights, by C. C. Patterson, J. W. T. Walsh A. K. Taylor, and W. Barnett (*illus.*) (*concluded*)	763
The Institution of Electrical Engineers	765
New Electrical Devices, Fittings and Plant (*illus.*)	767
New Patents Applied for, 1919	768
Abstracts of Published Specifications	768
Contractors' Column ... ... Advertisement page	xxvi

THE PRICE OF THE "ELECTRICAL REVIEW."

During the War, almost exceptionally among technical publications and periodicals of the character of the ELECTRICAL REVIEW, we have refrained from increasing the price. Owing, however, to the constant increases in cost of paper, printing, engraving and production charges generally, we have reluctantly decided that the price from the beginning of next year must be raised to 6d. per copy. The change will not apply to unexpired subscriptions.

Annexed will be found the revised rates for new subscriptions and for renewals:—

SUBSCRIPTION RATES, Postage Free.

UNITED KINGDOM and CANADA £1 12 6 per annum.
COLONIAL and FOREIGN .. .. 2 1 6 do.

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: AGENCY, CENT., LONDON." Code, A B C.
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.
AUCKLAND N.Z.: Gordon & Gotch, Albert Street; Peter G. Tait, P.O. Box 392.
BRISBANE, Gordon & Gotch, Queen St.
CHRISTCHURCH, N.Z.; Gordon and Gotch, Manchester Street.
DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.
JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c. Central News Agency, Ltd.
LAUNCESTON: Gordon & Gotch, Cimitiere Street.
MELBOURNE: Peter G. Tait, 90, William Street; Gordon & Gotch, Queen Street.
MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 25, Park Place
PARIS: Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Loescher & Co., Corso Umberto 1° 307.
SYDNEY: Peter G. Tait, 273, George Street; Gordon & Gotch, Pitt Street.
TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch 132, Bay Street
WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (to Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "London City and Midland Bank, Newgate Street Branch."

THE ELECTRICITY SUPPLY BILL.

THE Bill is now passing through the House of Lords, and apparently the enemies of electricity—and some who pose as its friends—have thought the moment a favourable opportunity to explode a bomb in its path. With this end in view they have emitted a preliminary cloud of misstatements, half-truths, and irrelevancies by way of camouflage, and we fear that serious harm to the industry may result from their ill-omened activities.

We make no claim for perfection or finality on behalf of the Bill; we readily grant that it has grave defects which we should be glad to see remedied—but public opinion must prevail, and public opinion has clearly decided that the future of electricity supply in this country must be subjected to public control in some form. While we retain the conviction that State control is less efficient than private control, and that the latter is vastly more conducive to enterprise and progress than the former, we recognise that it is useless in these days to argue the point—the question has been settled, and it remains for us to make the best of it.

The basic principle of the Bill has been accepted by all parties—namely, the centralised control of the supply industry by a Board of Commissioners; this in itself is an immense step forward. All experts are agreed, too, that the existing system of generation and supply in innumerable small packets is fundamentally wasteful and unsound. The matter has been clearly stated in an excellent letter to the *Times* of November 28th by "An Engineer" as follows:—"The case for unified electric supply rests on (1) cheaper production by a few large than by many small power stations; (2) cheaper distribution by one large than by several small undertakings." Those statements cannot be contested by any person qualified to form an opinion on the subject, which is a highly technical one. The Bill outlines methods by which these desirable ends can, it is believed, be attained. Unfortunately, serious misapprehensions appear to prevail regarding these methods, and we shall endeavour to dispel them.

For instance, in *The Times* of December 5th Mr. W. F. Fladgate, a director of electricity supply companies, in a somewhat inconsistent letter, asks why not allow the present undertakers to "carry on" under the direction of the electricity commissioners? Now, this is precisely what the Bill proposes. After delimiting the supply areas, in consultation with the authorised undertakers in each area (Clause 5, 1), the Commissioners are to consider whether the existing organisation in an area can be improved, and if so, they are to give the existing undertakers and other interested parties an opportunity to formulate a scheme for effecting such improvement. Where necessary, a joint electricity authority will be *voluntarily* formed for the purpose, and it is only in

the event of failure of the parties to agree upon a suitable scheme that the Commissioners are empowered to form a District Electricity Board. How could the necessary reorganisation be effected by the existing authorities without the formation of a joint authority of some kind? The threat of coercion is absolutely indispensable, but we firmly believe that with the alternative of a District Board in view, the various interests in an area will do their utmost to arrive at a satisfactory agreement, and endeavour to make the best use of their existing organisation and resources. Then as to capital expenditure, Mr. Fladgate cites the 20 millions with which the Ministry of Transport can carry out new works, and the 25 millions which the Electricity Commissioners are empowered to lend to boards or undertakers, and declares that at least 150 millions will be required to purchase stations and mains (if District Electricity Boards are set up); he expresses difficulty in seeing how the interest (at 6 per cent.) on the outlay can be covered by economy in working, during the building-up of the load on the new plant, but later on he says that if the existing undertakers were allowed to continue, with the restrictions as to tenure removed, after a few years "there would be no difficulty in raising the necessary capital for further improvements." Why it should be difficult to pay interest in one case and not in the other is not obvious. But it is clear that the constitution of a joint electricity authority does not have the effect, as in the case of a district electricity board, of causing all generating stations and main transmission lines to vest in the authority; moreover, if a joint electricity authority is constituted, it is armed with wide powers for borrowing money, charged upon the authority's property and revenues, or for issuing stock, and thus there is no question of the authorised capital outlay being limited to 25 or 45 millions—it is unrestricted. In fact, the authority would be in the same position, subject to the sanction of the Commissioners, that a great municipality such as that of Manchester or Glasgow is in now, subject to the Ministry of Health, so far as the raising of funds is concerned. The Bill provides for the transfer to the authority of the whole or any part of an undertaking *upon such terms as may be provided by the scheme*, and the price payable on the transfer of a generating station or transmission line may be the subject of agreement; only in the absence of such agreement does the "standard price" apply, and if the owner can show that that price would work injustice, the matter is to be referred to arbitration.

Mr. Fladgate's letter brought forth one from Mr. E. Garcke, president of the British Electrical Federation. He welcomes the appointment of the Commissioners, but describes the rest of the Bill as "awful from every point of view." No attempt is made to substantiate this bald statement, and the only suggestion is that the recommendation of a "special committee of the Institution of Electrical Engineers" be followed. That Committee, as we have pointed out, was not "of the Institution of Electrical Engineers," but was convened by the Institution, and its report by some mistake was promulgated as coming from the Institution. Later the Institution Council issued a report, but it was very different in substance. The first report, which Mr. Garcke quotes, was the one which deprecated special legislation, and urged that immediate action should be confined to the appointment of the Board of Commissioners, with judicial and advisory powers only—a Board which we characterised at the time as a nerveless figurehead of an authority. Mr. Garcke prophesies that if the Bill be swallowed, electricity supply will shortly be "sick unto death!"

The Times itself has taken up an attitude hostile to the Bill, and has put forward a number of erroneous ideas with regard to the Government proposals. In its issue of November 27th it speaks of the "replacement of haphazard private enterprise by national undertakings, placed near the sources of coal," apparently unaware that the great bulk of electricity supply in this country is in municipal not private hands, that the undertakings will not necessarily be "national" (many of them will undoubtedly be carried on very much as at present), and that there is no intention of placing the power stations near the coal pits—unless the latter happen to be suitably situated. It goes on to say that "no economy of our material resources is contemplated"—an extraordinary mistake; an economy of 55 million tons of coal was foreshadowed by the Coal Conservation Sub-Committee, on the *present* output of manufactured products, and the total possible national advantage was put at 100 millions sterling. Assuming that "production, no doubt, would be centralised and moved nearer the coalfields," it questions the relative cost of transmission lines on the one hand and the transport of fuel to existing stations on the other; but long-distance transmissions are not contemplated. Dealing with the "equalisation of the load," the *Times* says "the wastage arises in direct proportion to the size of the producing plant." What wastage? The statement, taken literally, is ridiculous. "An Engineer," in the letter above mentioned, kindly takes it to mean the idle time, the difference between a load factor of unity and the actual load factor, but even if it can have this meaning, it is, as he says, untrue. One of the chief objects of the Bill, as the Government representatives on Standing Committee B repeatedly pointed out, is to improve the load factor of the system. Further, the *Times* refers to the high cost of construction nowadays, which would prevent any reduction in the price of energy, and this brings us to an important point which has been misunderstood or misrepresented elsewhere also.

It is clear that the existing undertakers would have to pay the same high prices for new construction as the joint authorities or the district boards—or higher still, as the latter could order larger sets—and they would have to extend their plant very soon, for the demand has already risen to pre-Armistice standard and in some cases beyond that value. By concentration of plant, the use of large sets, and linking-up, the capital outlay will be reduced to a minimum, and the cheapest possible supply will be given. But what is "cheap"? The opponents of the Bill argue that it will not cause a reduction in the price of energy—can they suggest any means that will do so, under present conditions? If so, let them produce it. With the value of money depreciated 60 per cent., anyone can see that no *reduction* in price can be hoped for—but if an *increase* in price can be avoided, electrical energy will be *relatively cheap*, and that is the point of fundamental importance. When we talk of cheapness, let us always bear in mind what we mean by cheapness. The *Times* concludes by suggesting the appointment of "a small permanent committee of experts" to conduct research and give advice—the identical body which we have already described as a nerveless figurehead.

The *Daily Mail* of November 25th also opposes the Bill, which it professes to regard as "a scheme to waste electric power"! The *ipse dixit* of the *Mail* is hardly sufficient to carry conviction on this point to the mind of the engineer. "There are very strong scientific arguments against the Bill": these turn out to be statements by Lord Moulton, who is cited as "the greatest living authority on the subject"!! We have a great respect for Lord Moulton, who has done splendid work for the nation, but we should imagine that he gasped when he read that line. The *Mail's* special representative further repeats the old error, that 16 super-stations are to be erected, and refers to the estimated saving of 100 millions sterling per annum as if it were alleged to be effected in the cost of generating electricity (actually, of course, it represented the total *national*

advantage that was expected). Lord Moulton took the same view, and upon it as a text he based an attack upon the use of electricity for distributing heat. That was the only ground on which he could venture upon a comparison of gas and electricity; the truth of the matter, as he must be aware (being "the greatest living authority on the subject") is that the main purpose of the Bill is to supply power as cheaply and abundantly as possible; the Bill is the direct outcome of the report of the Committee appointed to consider the question of *electric power supply*. The Coal Conservation Sub-Committee pointed out that "one question which has been settled conclusively during the past 15 years is that the most economical means of applying power to industry is the electric motor"; in the munition factories put down during the war "95 per cent. of the machinery is driven by electricity, and it is only a question of time for all power to be applied in this way." Power supply is the very essence of the Bill—so Lord Moulton, learned in the law, seeks to confuse the issue and stampede public opinion by attacking the use of electricity for distributing *heat*. For this purpose he quotes Sir Dugald Clerk's statements; which are grossly misleading. Sir Dugald says that out of every hundred heat units in the coal consumed, gas delivers 75 heat-units to the user, whereas electricity delivers only 17.6; he does not say, however, that the latter is the *net figure*, capable of *complete utilisation*; his 75 heat units are latent in the gas, coke, and tar, and are the *gross figure*, which cannot be utilised to the full. In point of fact, when these combustibles are burnt, the user does not usefully receive even 17.6 heat units per 100 in the coal consumed.

The coal merchant might with equal justice and greater accuracy claim to have the best system of all; for he does really deliver cent. per cent. of the heat energy contained in his coal!

Such statements as these—the comparison of incommensurable quantities—cannot be regarded as bona fide; they are calculated to mislead the public, which cannot discriminate between heat units actually available and heat units in the potential or latent form. The wine merchant sells wine—the fruiterer sells grapes, from which a small percentage of wine could be made; it would be just as sensible for the latter to disparage the wares of the former as it is for the gas advocates to decry the product of the electricity works. All this is in reality a side issue, of no importance in fact; but the public is being hoodwinked, and we must therefore endeavour to open its eyes.

Again, Lord Moulton attacks the scheme on the ground that centralised generation at points "connected with the localities where the users reside by many thousand miles of mains everywhere open to attack at the hands of a handful of the disaffected" opens the door to the stoppage of all our industries at a moment's notice. This preposterous statement really calls for no refutation in an electrical paper, but as it comes from "the greatest living authority" we must touch upon it. First, we again point out that the "many thousand miles of mains" are purely a product of imagination; no one proposes long-distance transmission. With this country divided into 16 areas, each containing two, three, or more big power stations, linked together, the mains would nowhere be very long, and complete interruption would be an extremely difficult matter necessitating a widespread conspiracy and elaborate organisation in each area—practically civil war or rebellion. But what is Lord Moulton's alternative? Gas, and the by-products of gas making! Gas for motor traction ("even producer gas," with less than 150 B.TH.U. per cubic foot!), gas for heating, gas for power—and what about the miles of gas mains, "everywhere open to attack"?

The discussion in the House of Lords last week led to similar misstatements. Lord Downham repeated the tales about 16 superstations and 150 millions outlay, &c., and said that if treated with justice, the electrical undertakings would agree to organise schemes under which small stations would be scrapped, larger stations used in combination, and the best use made of the undertakings to get the best possible supply of electricity. Would it surprise him very much to know that that is precisely what the Bill asks them to do? (Clause 5, 2) and that the terms of purchase in that case may be the *subject of agreement*? (Clause 5, 6). Lord Moulton followed with a violent attack on the principle of the Bill, apparently repeating much of his *Daily Mail* tirade, and secured an adjournment. We were glad to see that, in the resumed debate, the Lord Chancellor pointed out that apparently not one of the opponents of the Bill had taken the trouble to read it; and their assumptions, mostly based on Lord Moulton's remarks, had not the slightest foundation. That is the trouble, and it is not limited to members of the Upper House.

It is greatly to be regretted that the consideration which led to the initiation of the electricity supply scheme is almost wholly ignored by those who discuss the subject. That consideration was the urgent necessity of economising fuel, and it is just as urgent now as it ever was. The gas advocates for their own purposes have dealt with it in their own way, invariably assuming that the coal consumed by electricity works is of the same quality as that which they themselves employ. But this is a first-class error, or worse. While gas can only be made from coal of a fairly high quality, electricity works can use low-grade coal which is practically useless for other purposes, and in many cases would either be left in the pit or thrown away. The utilisation of waste coal is just as important as that of waste heat.

London Wiremen's Wages.

Elsewhere we give particulars of the decisions of the National Joint Industrial Council for the Electrical Contracting Industry with regard to the standardisation of wages, and the division of the country into four "grades." These decisions were ratified *unanimously* by the Council, which consists of representatives of employers and employés in equal numbers, and therefore ought to be loyally accepted by both parties. It will be observed, however, that the schedule does not cover London, and we reproduce with it a communication from Mr. L. G. Tate, general secretary to the Federation, describing the negotiations which took place between the London Section of the Federation and the London Branch of the Electrical Trades Union, from which it will be seen that they resulted in a deadlock. The matter has been under discussion since October, 1918, when the Union applied for 2s. 6d. an hour plus 12½ per cent., and double pay for overtime. On Saturday last, according to the *Daily Herald*, a ballot of London members of the E.T.U. resulted in an overwhelming majority "in favour of action," the conduct of affairs being entrusted to the Executive of the branch.

What will follow is uncertain. A strike on the part of the E.T.U. would involve electric power stations for public and railway supply in the London area, but the recent experience of the railway strike gives good ground for believing that there would be no great difficulty in maintaining the supply with voluntary aid. As regards installation work, there is plenty of it in hand, but the public as a whole would not be materially inconvenienced by a strike. The London employers have for so long a period been subjected to endless worry and disturbance, not only by the demands of the employés, but also by their deliberate adoption of the go-slow policy, that they will probably be glad of a rest. Some of them will be inclined to close their businesses altogether and take to farming or some other trade in which life is still worth living. But we don't think there will be a general strike of wiremen just at present.

COIL v. MAGNETO IGNITION.

By A. C. BOOTH, M.I.E.E.

I HAVE read with very much interest the article by Mr. C. Sylvester, A.M.I.E.E., in your issue No. 2,189 of November 7th, regarding coil *v.* magneto ignition, and can thoroughly endorse, as the result of practical experience (on a motor car, not an aeroplane), all that he states in favour of the former. In this respect it may be of interest not only to your readers but to the British motor industry as well if I describe the arrangement that has proved so satisfactory in actual use.

To avoid any misunderstanding I must preface the information with a statement that I have no interest in any part of the equipment other than that of a satisfied user, and that I would prefer to see British industry in the forefront. On the other hand, I have no hesitation whatever in giving credit where credit is due, even though it be to those who are not Britishers, primarily in justice, secondarily with a view to encouraging our own people to do likewise if they are unable to do better.

In 1915 I purchased an American car fitted with electric lighting and an electric starter, by secondary cells charged from a dynamo which could also be used as a motor. This equipment has given me complete satisfaction over a period of nearly five years. Energy is provided for starting the engine from "cold," even in winter, for lighting seven lamps, for firing the engine and for actuating the horn. Up to date the car has run some 9,000 miles, mostly on short journeys, and the engine has never once been started by the handle. The sparking plugs have never been changed, and their points have been re-set only two or three times. The small mileage is, of course, due to the war, but the short journeys have meant very frequent engine-starting and a consequent heavy tax on the batteries, but the three cells have stood up to the work and have not so far required any attention other than a little distilled water once a month. They, of course, require charging twice a month either by running the engine as on ordinary journeys or by other means.

I enclose an explanatory diagram of the equipment showing details of the connections which may be of use to your readers. A reserve battery of five dry cells *dried up* two or three years ago, and as it was never required I removed it and its wiring. A great point in favour of the equipment is that no voltmeter or ammeter is fitted to bother the non-electrical driver. The charging is quite automatic, and there are no switches that have to be operated according to the speed of the engine. The coil is of the non-trembler type, giving only one spark per cylinder on firing, and I attribute my freedom from plug trouble largely to this fact. The "make-and-break" contact below the distributor is of substantial size, and has been re-set not more than four times. Not that it was necessary even then. The reason why this point has given so little trouble is, I believe, due in a great measure to the correct wiring. In the old days of coil ignition in this country almost every British car had the connections so arranged that the path of the secondary current was through the break of the primary. This led to rapid burning of the contact and consequent trouble, and was a great factor in favouring magneto ignition in which the connections were correctly made.

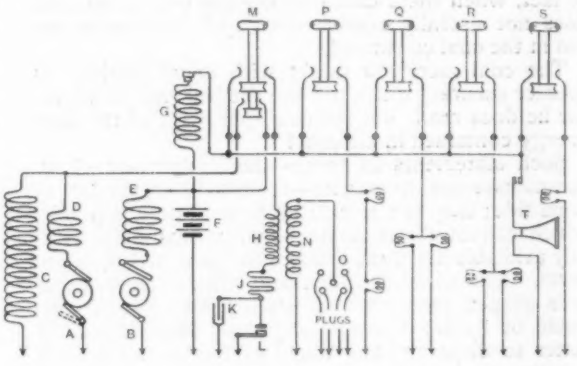
The diagram is almost self-explanatory, but it is not quite in accordance with the original wiring, as I have made some minor alterations. It will be noticed that the wiring is single, and that the frame of the car and engine are used as the "earth" or return circuit. This method considerably simplifies the wiring, and although there have been no shorts, I should imagine that faults, when they do develop, will be much easier to locate than with double wiring, which, generally speaking, requires two faults before any indication is given that trouble has developed. The two faults as a rule occur in different places, and the indications are often very misleading and puzzling.

The lamps are fitted with one central contact, the other end of the filament being joined to the brass sleeve. There are many of these sets in use in this country, but for those who are not acquainted with the operation a brief description may be useful:—

(1) *To Start Engine.*—(*a*) Pull out button M. This starts the dynamo revolving slowly as a motor due to the current having a path from the cells through the armature and field coils.

(*b*) Next slowly depress the starting pedal. This action pushes the motor pinion into gear with the fly-wheel, then removes one dynamo brush and drops the raised motor brush, resulting in the motor revolving rapidly and consequently turning over the engine at a speed somewhat greater than can be done by hand.

(*c*) When engine fires, release immediately the starting pedal. This raises the motor brush and



A, Dynamo; B, Motor: C, Shunt winding; D, Reverse series winding; E, Motor winding; F, Three secondary cells; G, Magnetic circuit breaker; H N, Spark coil; J, Resistance; K, Condenser; L, Make and break; M, Switch for dynamo and spark coil; N, Secondary coil; O, Distributor; P, Switch for tail lamp and red pilot lamp on dashboard; Q, Switch for two side lights; R, Switch for two head lights; S, Switch for dashboard light; T, Electric horn.
↓↓↓ indicate framework of car or engine.

FIG. 1.—DIAGRAM OF CONNECTIONS.

drops the dynamo brush, as well as releasing the gear. The dynamo then charges the cells, besides supplying energy for ignition and lighting.

(2) *To Stop Engine.*—Push in button M. There is nothing else to be done.

The combined motor and dynamo has three field windings, two armature windings and two commutators. Each commutator has one brush permanently on, while the other two brushes act as the switch for joining up as required either the motor or dynamo according to whether the starting pedal is in action or released. The dynamo begins to charge the cells when the speed of the engine is at about 350 revolutions. Excess current is avoided by the "reverse series winding." Excess current through the spark-coil is avoided by the bare wire resistance which heats up and increases in resistance if the current is prolonged.

The magnetic circuit breaker does not act until about 25 amperes flow through the coil, when it starts vibrating, and cuts down the current at once to about 4 amperes. In addition, the noise it makes in vibrating calls attention to the fact that there is

trouble somewhere. There are no fuses to worry about.

Although head lamps of 12 c.p. were provided, I find that the side lamps of 6 c.p. when placed in the head lights are sufficient for night driving up to the legal limit, even with the war reduction of head light area to 5 in. diameter. The tail lamp and dashboard lamp are each 2 c.p.

The great convenience of electric lighting, and the economy of petrol that follows by stopping the engine on every opportunity, are such obvious advantages that I fail to understand how it is possible for anyone to support magneto ignition and acetylene lighting.

[We have ascertained from the author that the equipment is known as the "Delco."—Eds. Elec. Rev.]

THE SHERINGHAM DAYLIGHT.

By H. D. T.

At a recent meeting of the Illuminating Engineering Society a new device was exhibited for the first time, by means of which artificial light can be made to closely imitate daylight. It is the invention of Mr. George Sheringham, the artist and designer, who, in recent years, has taken a prominent place in the world of decorative art. The interest aroused by this demonstration has come as a surprise to many, and probably to no one more than the artist himself, but when one realises the absolute necessity of some standard light by which to judge colour values, and understands further the importance of colour in our industries to-day, the reason for such widespread interest is not far to seek. The standard light for artists has always been white diffused light from a north window. In our northern latitudes, direct sunlight is too uncertain and of too variable a character; it cannot compare, for purposes of standardisation, with diffused light which, though of varying intensity, remains reasonably constant in the colour value of its spectrum.

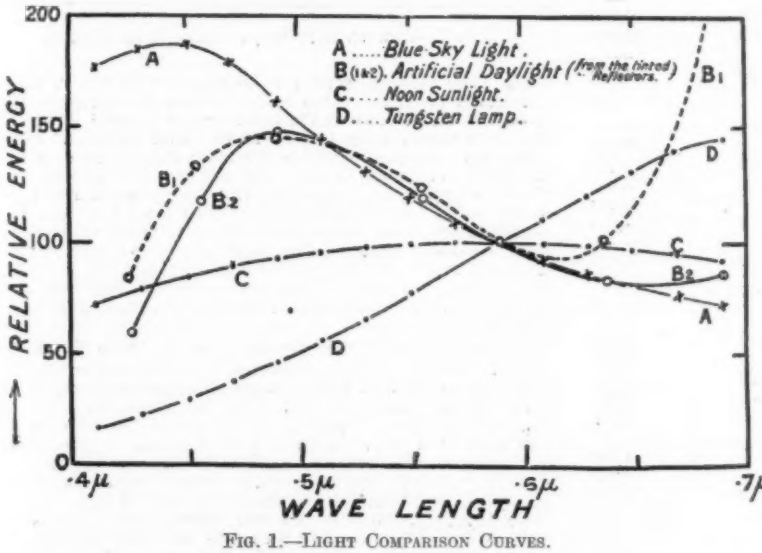


Fig. 1.—Light Comparison Curves.

A glance at the accompanying diagram (fig. 1) will show clearly the difference between sunlight and daylight. Sunlight, it will be noticed, contains about the same proportion of the colours found at each end of the spectrum, and is relatively richer in the oranges and yellows of the middle. In daylight, on the other hand, the red and yellow rays are comparatively less luminous, and the values rise rapidly, and almost constantly, until the blues and violets are reached, the excess of these rays over the reds and yellows being much greater than in direct sunlight. In the electric light curve the reverse is the case, by far the larger proportion of rays coming from the red end of the spectrum, while those from the violet end are almost negligible by comparison. In considering this question of colour reflection, it must always be borne in mind that colour is simply a sensation, due to the perception of certain waves in the ether by the eye; a coloured surface, for example, is simply a surface which reflects an excess of rays of particular wave lengths; in other words, the colour lies not in the material, but in the light reflected from it. At present our pigments reflect all, or nearly all, the colours of the spectrum, in greater or less proportion, and it is this that causes so great a difference in the apparent colour of a material when viewed in daylight, and when viewed in electric or other artificial light, and makes diffused light so important as a standard for the true judgment of colour values. It is this, so-called "north window light" that Mr. Sheringham has set himself to imitate in the "daylight shade" which forms the subject of this article.

It is by no means the first time that an attempt has been made to solve this complex problem, for its importance in the innumerable trades where exact colour matching, grading, and mixing play so prominent a part, makes its solution one of the outstanding industrial needs of to-day, but, as will be shown, in this invention, the solution has been sought in a new and probably more practical way. In this apparatus the light from an electric bulb (or other source of artificial light) is thrown on to a shade, on the under side of which is a colour design worked out in accordance with the light absorption curve of the colours employed as determined by the Abney colour patch apparatus. In effect, a portion of the red and yellow rays are absorbed, and the blues and violets *apparently* re-enforced. It should be remembered that it is reflected light with which we are dealing, and not direct rays. It is impossible, of course, to obtain more blue or violet rays than are present in the source of light, but, owing to this absorptive action of the pigments, the *proportion* of blue and violet is increased. By referring to the diagram (fig. 1) it will be seen that the distribution of energy in the new light is almost parallel with that of the light of a north window, thus giving the illusion of daylight. By way of analogy, consider the effect produced by an orchestra which is too strong in bass instruments. The delicate harmonies of the woodwind cannot be heard; they are there, but they are overpowered by the bass. If some of the bass instruments are removed, the chords can now be heard in their true proportions.

The device was originally constructed by the artist in the autumn of 1918, the colour design being worked out empirically and the light used in his own studio, but many additional months have been occupied in the perfecting and adjustment of the apparatus, and for this Mr. Sheringham has been indebted to the work of two collaborators: Major Adrian Klein, M.C., and Mr. L. C. Martin. Major Klein, now adviser in colour physics to the Calico Printers' Association, and formerly head of the experimental department of the Camouflage School, has brought to the work a knowledge and appreciation of dyes and pigments which has been of the utmost service to his confrères, and it is largely on the special absorption qualities of these colours that the efficiency of the present apparatus depends. Mr. L. C. Martin, of the Optical Department of the Imperial College of Science and Technology, who brings to the work not only his own experience in optical research, but has also had access to a large amount of statistics and data on colour testing, the work of Sir William Abney, has done invaluable work in testing and improving the light curves, the result of which can be seen on the diagram. It may be noted, in passing, that the unit has been improved since the printing block was made, so that the curve of the new light now shows less falling off at the extreme violet end, although as this end approaches the "invisible" violet rays, the actual difference in the visible spectrum is not so great as the diagram would make it appear.

The light efficiency of the unit compares favourably with previous efforts to obtain artificial daylight, and for purposes of rough approximation it may be taken that the unit cost per candle-power of the new light, when using the latest type of metallic-filament lamp, will be about the same as the cost of lighting with the old-fashioned carbon-filament lamp. When the advantage to our colour industries of an artificial extension of daylight hours is taken into account, the extra cost of the new lighting system should be almost negligible on a factory's balance sheet, and, as the first cost of the apparatus is likely to be reasonable, there seems little doubt that it will receive favourable consideration.

It should be added that the research work in connection with the light is still in progress, so that some of the present data may be modified when the final results are made known.

American Electric Traction Expenses Still Increase.—In spite of the numerous fare increases granted during the last year, the latest figures show operating expenses of the electric railways increasing at a greater rate than revenues. Net income after payment of taxes and fixed charges was 1.54 cts., as compared with 2.23 cts. per car-mile in 1918, a falling off of 30.94 per cent. The operating ratio in July, 1919, was 75.30, compared with 70.85 per cent. in July, 1918, an increase of 6.28 per cent.—*Electrical Review*, Chicago.

TRADE STATISTICS OF EGYPT.

The following statement, showing the imports of electrical and similar goods into Egypt during the year 1918, is taken from the recently-issued trade statistics. The figures for 1913 are added for purposes of comparison, and notes of any increases or decreases are given :—

	1913. £E	1918. £E	Inc. or dec. £E
Steam engines, including boilers, &c.—			
From Great Britain ...	128,000	34,000	– 94,000
,, Switzerland ...	2,000	1,000	– 1,000
,, United States ...	1,000	—	– 1,000
,, France	8,000	—	– 8,000
,, Other countries ...	43,000	—	– 43,000
Total ...	182,000	35,000	– 147,000
Electrical machinery.—			
From Great Britain ...	15,000	12,000	– 3,000
,, United States ...	3,000	—	– 3,000
,, France	27,000	1,000	– 26,000
,, Italy	3,000	1,000	– 2,000
,, Switzerland ...	1,000	6,000	+ 5,000
Total ...	49,000	20,000	– 29,000
Petrol and benzine motors.—			
From Great Britain ...	62,000	19,000	– 43,000
,, France	1,000	—	– 1,000
,, Italy	22,000	—	– 22,000
,, Switzerland ...	29,000	35,000	+ 6,000
,, Other countries ...	32,000	—	– 32,000
Total ...	146,000	54,000	– 92,000
Lamps of all kinds and parts.—			
From Great Britain ...	6,000	13,000	+ 7,000
,, Germany	21,000	—	– 21,000
,, France	6,000	13,000	+ 7,000
,, Italy	1,000	2,000	+ 1,000
,, Holland	2,000	13,000	+ 11,000
,, Switzerland ...	—	1,000	+ 1,000
,, United States ...	—	—	—
,, Japan	—	21,000	+ 21,000
,, Other countries ...	37,000	6,000	– 31,000
Total' ...	73,000	69,000	– 4,000
Copper, manufactured.—			
From Great Britain ...	11,000	11,000	—
,, Germany	20,000	—	– 20,000
,, United States ...	—	2,000	+ 2,000
,, France	17,000	4,000	– 13,000
,, Italy	6,000	—	– 6,000
,, Other countries ...	5,000	17,000*	+ 12,000
Total ...	59,000	34,000	– 25,000

* Japan 7,000. Russia 8,000.

Scientific instruments.—			
From Great Britain ...	20,000	41,000	+ 21,000
,, Germany	21,000	2,000	– 19,000
,, United States ...	2,000	5,000	+ 3,000
,, France	14,000	16,000	+ 2,000
,, Italy	1,000	2,000	+ 1,000
,, Switzerland ...	1,000	2,000	+ 1,000
,, Other countries ...	3,000	7,000*	+ 4,000
Total ...	62,000	75,000	+ 13,000

* Japan 7,000.

Other machinery (except agricultural).—			
From Great Britain ...	103,000	70,000	– 33,000
,, United States ...	30,000	9,000	– 21,000
,, France	36,000	8,000	– 28,000
,, Italy	5,000	1,000	– 4,000
,, Switzerland ...	9,000	6,000	– 3,000
,, Sweden	—	—	—
,, Holland	2,000	—	– 2,000
,, Other countries ...	48,000	3,000	– 45,000
Total ...	233,000	97,000	– 136,000
Electric, telegraphic, and telephonic apparatus.—			
From Great Britain ...	46,000	35,000	– 11,000
,, Japan	—	18,000	+ 18,000
,, United States ...	1,000	1,000	—
,, France	19,000	8,000	– 11,000
,, Italy	3,000	7,000	+ 4,000
,, Sweden	18,000	6,000	– 12,000
,, Switzerland ...	4,000	2,000	– 2,000
,, Other countries ...	48,000	7,000	– 41,000
Total ...	139,000	84.000	– 55,000

£E = £1 0s. 6½d

THE ROADS AND TRANSPORT CONGRESS AND EXHIBITION.

(*Concluded from page 734.*)

Messrs. Ransomes, Sims & Jefferies, Ltd., Ipswich, exhibited three machines representing the chief products of this company, including a standard "Orwell" 3½-ton chassis fitted with a specially large tipping body for refuse collection to the order of the City of Cardiff. The machine is twin motor driven, each motor being provided with a double helical reduction gear, the final drive to the rear wheels being by chains. The electrically-operated tipping gear, of the company's own design, is of the horizontal screw type, the motion being partly horizontal and partly vertical. The body is supported on a steel under frame, which is provided with a pair of rollers which run in channel-steel guides. Only 40 seconds are required to tip the vehicle when fully loaded. The accumulators are supported on two channel-steel cross members, which extend under the frame and project about 15 in. at either side of it. Small rollers are fitted at either side of the accumulator trays which are mounted on eccentrics; the latter are operated so that the rollers come into contact with the channel-steel cross members. The battery containers can then be rolled out quite easily. Other interesting exhibits were a 36-in. motor-driven lawn mower fitted with a single-cylinder 6 to 8 h.p. engine, and a road-making and mending machine. The latter consists of a platform fitted with jacks and mounted on a type C electric battery

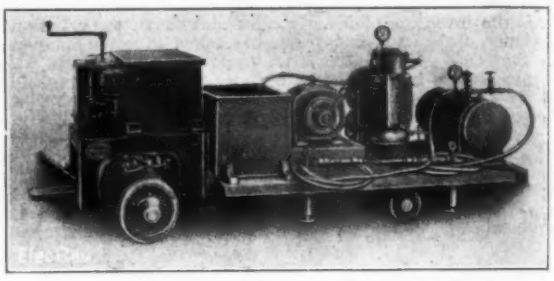


Fig. 7.—Orwell Electro-pneumatic Road Maker.

truck. The platform carries a 7.5 h.p. electric motor, which operates a compressor, the latter in turn driving pneumatic tools. When in position the jacks can be screwed down and the truck driven away to be used for other purposes. Fig. 7 illustrates a standard portable plant, for mounting on an electric truck, as shown, or any other self propelled vehicle. The standard duplex compressor is driven by means of a belt and jockey pulley by an electric motor which can be connected up to the street mains when available, or supplied with energy from a storage battery. The plant is provided with suitable air receiver for storage purposes and special water cooling arrangement, so that no separate water supply is necessary. In all cases the compressor is entirely enclosed, and amply lubricated.

Messrs. Edison Accumulators, Ltd., 2, Duke Street, St. James, London, S.W.1, exhibited a 5-ton Lansden tipping wagon fitted with an Edison electrically-operated tipping gear which is controlled by a pedal under the footboards to operate which a trap door is opened. In this model the batteries are contained in a steel casing held by brackets to the bottom of the frame side members, and fitted with rollers to facilitate removal. A single motor centrally situated behind the differential drives sprocket shafts through level gearing, the final drive being by chains to the rear wheels, which are of the wooden artillery type. The back axle is a solid forging, and strong radius rods are provided. The front axle is of rectangular section in the centre, but has the I-girder form at the ends. For the tipping gear, a motor, situated at the front end of the screw, operates through a silent chain. The vehicle was built to the designs of the Glasgow Corporation.

The General Vehicle Co., Ltd., 43, Shoe Lane, London, E.C.4, was showing a 3½-ton electric vehicle designed for house-to-house refuse collection and equipped with the Craymer unloader which can be either hand or electrically operated. The chassis itself, we understand, is the first to be built entirely in this country; it was made in Birmingham, the English company having bought all the American jigs, tools, patents, and patterns. The vehicle is fitted with an Iron-Exide battery having a capacity of 256 amp.-hours, which is claimed to be ample for a run of from 36 to 40 miles over average roads when fully loaded. The drive on this vehicle is arranged as follows:—An electric motor, placed just in front of the rear axle, drives forward by chain to a differential cross-shaft from which the final transmission to the rear wheels is by means of side roller chains to chain wheels on the road wheels.

Messrs. Hadfields, Ltd., Tinsley, Sheffield, exhibited as at other recent exhibitions manganese steel tramway products, including rails and a compound crossing.

The War Office exhibit consisted of various plant and materials used by, and a collection of photographs, drawings, &c., illustrating the work of the transport services at the front during the war.

The New Transport Co., Ltd., 27, Queen Victoria Street, London, E.C. 4, illustrated by means of drawings, models, &c., the Gattie system of transport and method of handling goods in large manufacturing and densely-populated centres. The principle is evolved around an electro-mechanical machine which automatically controls and sorts parcels and bales of merchandise. Arrangements were made for visitors who wished to do so to view the machine actually at work.

The Electric Appliances Co., Ltd., 8, Fisher Street, Holborn, London, W.C. 1, exhibited the Imperial vacuum cleaner which, we are informed, has recently been awarded the "Grand Prix" in competition with 18 other well-known makes and types of machine before a committee of engineers.

The Jackson Electric Stove Co., Ltd., 38, Blandford Street, London, W. 1. At this stand full demonstrations of a new model of Jackson electric cooking range were given. The exhibit comprised a comprehensive collection of domestic electric cooking and heating apparatus, and included irons, kettles, saucepans, heating rings, toasters, &c.

Messrs. Chas. E. Beck & Co., Ltd., 70, New Bond Street, W. 1, exhibited electric "Servants" for the home, comprising an ironing machine and the "Thor" washing machine, which is claimed to wash anything without damaging it in any way. The machine is essentially a labour-saving device, and is not only simple to operate, but requires no attention while in operation. Another advantage is that all moving parts are enclosed. We understand that the company is shortly expecting delivery from America of a consignment of electric vacuum cleaners.

Messrs. Berry's Electric, Ltd., 86, Newman Street, London, W., had on view a working exhibit of several types and sizes of "Magicoal" electric fires which imitate in a striking manner a glowing red-hot fire. The psychological effect is such that, looking at the red embers, even at their lowest consumption, makes one feel warm.

Messrs. Pirelli, Ltd., 144, Queen Victoria Street, London, E.C. 4, had on view an imposing exhibit of solid rubber tires, suitable for self-propelled vehicles of all types and sizes.

Messrs. Henley's Tyre & Rubber Co., Ltd., 18, New Union Street, Moorfields, London, E.C. 2. This exhibit comprised samples of solid rubber band tires of various sizes, and samples of submarine and house-wiring cable, &c. We understand that the exhibit was shown mainly with a view to calling attention to points of interest connected with Henley's house-wiring system which has been used with advantage in artisans' dwellings and housing schemes. The system is inconspicuous, efficient, and permanent; it is easily installed, and necessitates little cutting away and no damage to premises.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Speeding-up of an Induction Motor.

I was pleased to see Mr. G. J. Smith's remarks regarding the above matter. He compares it with a case which came to his notice and which he states was a similar case. I wish to point out that there was nothing at all similar in the two cases. The case I stated was a 3-phase supply, 50 cycle, 400 volts, with star point earthed. This is an entirely different supply from a 2-phase with one pole of each phase earthed.

In my case an "earth" on any part of the stator windings would bring the breaker out, and further there was not an "earth" or fault to be found. The case was stated to me by my partner, but candidly as an engineer of some experience I did not believe it, as I could not see how it could possibly take place. I thought someone else might have had a similar experience, but I am afraid not. If ever the mystery is solved I shall be glad to inform Mr. G. J. Smith of the "cause and cure."

Puzzled.

December 2nd, 1919.

Third Harmonics.

With reference to Major Edgcumbe's letter in your October 31st issue, in which he comments upon an article written by me, and dealing with third harmonics, as Major Edgcumbe is evidently under some misapprehension, I should like to point out to him that I did not for one moment advocate that generators should all run with earthed neutrals, but that each should be provided with a separate neutral resistance, which is another matter altogether. One or more neutrals can then be earthed, but it is not advisable to run more than two machines in this way on account of the heavy circulating currents which would be set up, owing to the neutralising effect, which takes place upon starting the windings, being negatived by paralleling-up the phases separately *via* the neutrals.

I certainly did not intend to convey the impression that generators should be equipped with separate earthing reactances, as, in the case referred to, the generators in themselves embody sufficient reactance to provide the necessary limiting factor. With a modern generator there is little to be feared from excessive circulating harmonic currents even though the neutrals be directly coupled together.

Major Edgcumbe also mentions that a reactance will return power to the circuit—usually at the wrong time—upon the circuit-breaker operating; this will, of course, depend very largely upon the speed with which the circuit is interrupted.

L. C. Grant.

Newcastle-upon-Tyne.
December 3rd, 1919.

Patent Office Library.

Will you kindly draw the attention of your readers to the accompanying copy of a petition asking the President of the Board of Trade to have the Patent Office library kept open until 10 p.m. daily?

The petition has the approval of a number of scientific and technical societies, and I shall be glad to forward sheets, for signature by any others who are interested, and also to hear from individuals who wish their names added but have not an opportunity of signing in person.

Chas. Salter.

33, Park Hall Road, London, N. 2.
December 3rd, 1919.

[We cordially endorse our correspondent's proposal. It is very necessary that every facility should be afforded for the dissemination of technical information; the cost is trivial compared with the benefit derived by the nation.—Eds. Elec. Rev.]

Electric Power Supply to Works.

Will you allow me to correct a deduction which might too easily be drawn from your account of my remarks on the above subject, as reported on p. 668 of your issue of November 21st?

It might be inferred from the figures, as reported, that the compound charge in the city of Sheffield was £4 per annum per K.V.A. of maximum demand, plus 0.44d. per unit metered, plus increment due to the coal clause. This is not the case. The ordinary compound charge is £4 per annum per K.V.A. of maximum demand, plus 0.25d. per unit metered, plus increment due to coal clause. Alternatively, instead of the increment due to the coal clause, a percentage increment, which has varied during the war from 25 per cent. to 75 per cent., may be added to *both* parts of the compound charge, and this alternative is often advantageous to the consumer.

To make the comparison clear, suppose the price of coal is 20s. per ton above the datum, that the coal increment is .03d. per shilling, and the alternative increment is 75 per cent. Then the tariffs are as follows:—

(*a*) £4 per K.V.A., plus (0.25d., plus 0.6d.)=0.959d. on 100 per cent. load factor.

(*b*) (£4 per K.V.A., plus .25d.)×1.75=0.6291d. on 100 per cent. load factor.

It is from the latter tariff that the unit charge of 0.44d. was quoted in your report, and I am glad to have an opportunity of explaining the matter fully for three reasons. In the first place, it is due to the city of Sheffield that there should be no misunderstanding. Secondly, the rates quoted are among the lowest in the country, and it should be specially remarked how favourable is the alternative rate to a certain class of consumer. Lastly, it is an excellent example of the disadvantage of secret agreements. For had the city of Sheffield subscribed to this practice, a full and frank explanation of the figures would have been impossible.

William Cramp.

Manchester,
December 2nd, 1919.

The Lay-out of Switchgear.

With reference to the second part of Mr. A. J. Webber's letter in the last issue of the Review, in which he asks when the D.P. switch and fuse reaches its limit and the D.P. circuit breaker takes its place, I feel quite justified in saying that he will never receive a satisfactory answer from anyone with practical experience. Mr. Webber's experience with fuses is that when he reaches the 600 to 800-amp. mark his troubles begin. Personally, my own troubles begin long before that mark is reached, and perhaps the following experiences may be of interest.

At present I am gutting a 3-phase distribution board composed of four ways of 400-amp. fuses and three ways of 200-amp. and replacing them with oil-immersed switches. The reason for doing so is that several of each size of fuse were giving trouble due to heating up at about ¾ full load, and the porcelain handles breaking up due to this heat and having to be bound together with tape, so that it was found

impossible to carry on. To withdraw one of these fuses it was necessary to tie a piece of rope round the metal work, put the knee against the board and get some assistance to pull out. When out it was found that the faces of the clips and the fuse heads were severely pitted and burned. The type of fuse on this particular board is made by one of the largest present-day makers, and the design is woefully weak.

On a D.C. board one of the feeder panels carries a pair of fuses rated at 500 amps., but at normal load, 350 amps., these fuses become very warm. One evening lately the load increased to about 390 amps., and the fuse heated up so much that it was decided to relieve it by bridging across its clips with a piece of No. 20 copper wire. The intention was to make up the equivalent of the fuse in the holder and to withdraw the holder for examination, but immediately the first turn of the copper wire made contact with the two-clip bolt it blew out with a bang. These fuses are also by a present-day maker, and *are not of ancient pattern.*

So much for large sizes; but what has one to say when 30-amp. fuses and bases are being continually smashed to pieces by a No. 26 copper wire blowing? It seems in this case that to thoroughly meet the requirements of the Home Office and Factory Acts these fuses and bases are being made so compact and the fuse wire itself so shielded that no provision is being made for the expansion of the gases caused by the fuse blowing, and therefore the cause of breakages can be put down to concussion.

These experiences with fuses are a few personally come across, and it is because of these that I feel justified in stating that no one can answer Mr. Webber's question.

Jos. Walker.

Musselburgh, *December 8th*, 1919.

The New Standards for Cables.

I thank Mr. F. W. Andrews for pointing out the error in my article of November 14th. I had been attempting to devise a decimal square measure in which each step was a tenth, as the French have it in the larger units of their square measure. As regards the submultiples of square inches it ran somewhat as follows. The words "inch area" (or square inches) were contracted to "inare":—

1 inare = 1.0 sq. in.
1 decinare = .1 sq. in.
1 centinare = .01 sq. in.
1 milinare = .001 sq. in.

In my article, for 1 sq. mil, read 1 milinare. It is needless meanwhile to rewrite the article, as its general purpose is clear to those interested. The error is at least another proof of the need for a simple system of naming cables for rapid use by everyone.

Already one finds some naming the new standards by diameter and some by area, and both figures in minute fractions of an inch are clumsy and difficult to remember correctly. Their proper place is in a table for reference when required.

For everyday use, recognition by area is what is really needed, and if a suitable unit name were selected for .001 sq. in. it would be very helpful.

D. S. Munro.

Edinburgh, *December 6th*, 1919.

The new table of sizes is very troublesome to remember, and doubtless will lead to much confusion. The difficulty can, however, be overcome if we speak of .0010 as No. 10 and .0015 as No. 15, &c. The cables in use would thus be No. 10, No. 15, No. 20, No. 30, No. 45, No. 70, and No. 100. These would be easy to remember. I think that the adoption of such a method of naming them would save much confusion.

C. Turnbull.

Electricity Works, North Shields, *December 8th*, 1919.

Heating of Induction Motor.

Trouble: Stator-core heating of 3-phase, 3,000 volt, 50-cycle, 290 rev., 250-B.H.P. haulage motor. Experiencing overheating of this machine I came to the conclusion that there was trouble in the core, and decided to take this to pieces. I found that the laminations were made up in six sections forming the complete circle, and in between each section there was consequently a small space, about .008 inch. Each complete circle of laminations was alternately varnished (both sides) and plain and so placed that the spaces between sections came central on the section above and below it. I found that on each side of the spaces there had been heating enough to temper the laminations to dark blue for about 1½ inches from the end, and gradually to light straw colour at about 3 to 4 inches away.

This appeared to be quite local heating, and was only apparent at the centre of the adjacent lamination to a slight degree when the varnish was washed off.

This machine is of German manufacture, made in 1905. I notice that some English machines have very much more depth of iron for less power, and by this I judged that this machine was running at a high magnetic density; following this conclusion I thought the heating might be caused by eddy currents produced by breaking the magnetic field at the six points in the circumference, causing local magnetic polarities, and when running at a high density the magnetic field would be carried some distance each side of the gap and cause eddy currents to form near the ends of the laminations. Now this happens at twelve points in the circumference, and considering that there are over 7,000 sections of laminations, there is considerable heat to dissipate independently of the usual heat losses.

I may say that each section contains 30 slots, there being 180 slots in the machine, and the depth of slot is 1¼ in., and the remaining depth also 1¼ in., making the total depth of magnetic field only 3¼ inches.

Am I correct in my assumption and should I be better off by cleaning the laminations so as to make a true magnetic ring of every two complete circles, being careful, of course, to varnish between each two sets?

Can anyone give a chemical formula for cleaning the plates to make good metallic magnetic contact?

G. F. Flanders.

Aberaman, *December 7th*, 1919.

THE "NI-FE" ACCUMULATOR.

A NEW type of storage battery, that has been put forward for use in miners' lamps and which has never before been produced in England, is being placed on the market by BATTERIES, LTD., of Redditch. The NI-FE accumulator, as the chemical symbols indicate, is of the nickel-iron-alkaline type; its manufacture on a large scale was commenced in 1911 by a Swedish company, but Batteries, Ltd., have obtained the patents and patent rights for the United Kingdom and the Colonies.

The active material of the NI-FE positive electrode is nickel hydroxide, mixed with other ingredients to increase the conductivity. This composition is formed into briquettes, which are automatically fed in between two inactive perforated nickelled steel strips. These strips, enclosing the active material, are manufactured in lengths and then cut up into suitable sizes. They are then folded together and fitted into a steel frame. The complete electrode is then put through a rolling process, which ensures perfect contact between the active material and the nickelled steel strips. At the same time grooves are formed on the plate, which keep the Para rubber insulators in position. The active material of the negative electrode is iron oxide specially prepared and mixed with other materials, which are claimed to prevent self-discharge of the cell. The negative plates are constructed in the same way as the positive ones. The interior of a complete cell consists of a series of positive and negative plates, insulated from each other by Para rubber strips. Plates of similar polarity are connected by a steel plate brazed across their tops, to which in turn is brazed a pole terminal. There are no nuts or screws which can become loose and cause a short circuit. The container is made of steel, all joints being brazed to prevent leakage. The cover through which the pole terminals are taken is also brazed on to the container, and is provided with a flange to prevent spilling of the electrolyte. In the centre of the cover there is an opening for the insertion of a special gas valve or solid plug. The electrolyte consists chiefly of a solution of potassium hydrate in distilled water, of definite strength, and the density of the electrolyte remains constant during charge and discharge. The NI-FE accumulator is manufactured in two standard types:—Type "A" should be used where a battery for slow discharge is required, as for telegraphs, telephones, lighting purposes and ignition. Type "K" should be used where a battery for rapid discharge is required, as for self-starters, traction purposes, &c. This battery has a specially low internal resistance, and has been designed so as to operate successfully under the severest conditions. The electrolytic reactions of the accumulator are complicated, but in brief a discharged cell contains, in the positive electrode, nickel hydrate in a low degree of oxidation, whilst the negative electrode contains chiefly iron oxide. When charging takes place the nickel hydrate in the positive plates become more highly oxidised, whilst the iron oxide in the negative plates is reduced to chemically pure iron.

On discharging, the active material in the negative electrode becomes re-oxidised, whilst that in the positive electrode is reduced. The charging and discharging processes are apparently nothing more than the electrolytic carrying of oxygen from one plate to the other. The electrolyte does not enter into any permanent chemical union with the electrodes, but functions practically only as a liquid conductor. For this reason the quantity of electrolyte can be reduced to a minimum, and the plates can be placed as close together as is practicable. This results in a considerable saving of volume. The curve for a normal charge (six hours for type "A" and five hours for type "K") shows that the voltage at the beginning slowly rises during about 70 per cent. of the charge time from 1.4 to 1.5 volts, and then rapidly to 1.75 or 1.78, and remains so to the end of charging. By using the method of forced charging the time can be reduced to four hours for type "A" and three-and-a-half hours for

type "K." In this method a double current is used during the first 60 per cent. of the charge, which is then completed with normal current. During charging, some of the water in the electrolyte is decomposed and escapes as oxy-hydrogen gas, which is not corrosive. When charging is conducted at a constant pressure and completed in four and a half and three hours for types "A" and "K" respectively, a voltage of 1.52 volts per cell must be maintained for the whole period of charging. The current in the beginning will be approximately three times the normal, and will sink gradually to about two-and-a-half times the normal in one-and-a-half hours. Later it will fall more quickly to a half or a third of the normal and remain so to the end of the operation. Overcharging is not injurious to the cells. The curve for a normal discharge in eight hours (for type "A") and four hours (for type "K") shows an average working voltage for a cell of 1.2 volts. The voltage drops slightly during the first fifteen minutes of discharge, but after this it remains practically constant until the cell is completely discharged. No gases are generated during discharge; the accumulators can, therefore, be made unspillable, which is of importance in batteries

Fig. 1.—Assembled Electrodes.

Fig. 2.—Miners' Lamp Cell.

Fig. 3.—Railway Hand Lantern.

for ignition, hand lanterns, and all transportable purposes. The accumulators give a practically undiminished ampere-hour output, even at very high rates of discharge. A NI-FE battery will give about 90 per cent. of the guaranteed output, even when discharged with a current four times the normal. The ampere-hour efficiency of the NI-FE accumulator under normal conditions is from 75 to 80 per cent., and the corresponding watt-hour efficiency is from 60 to 65 per cent.

Cells of this class that have been standing idle for four or five years when tested are found to give nearly their full guaranteed output at the end of that period without recharging.

The overall dimensions of the miner's lamp cell (fig. 2) are 5 in. in height and 2.5 in. in diameter, and the total weight, including electrolyte, is 2 lb. The capacity is 11 amp.-hours and the voltage 2.5 volts. These figures show a result of 14 watt-hours per lb. of cell, which is remarkable for so small a cell. Referred to volume the capacity is 1.25 watt-hours per cu. in. This very high specific power has been obtained without any sacrifice of mechanical strength by means of the following arrangement of the interior.

The accumulator consists in reality of two cells, the containers of which are firmly brazed together. The negative pole of one cell and the positive pole of the other are connected to their respective containers. The outside terminals, which are taken through the container, give double the voltage obtainable from an ordinary cell. This cell gives a brilliant 2-c.p. light for ten hours continuously, and even at the end of that period the light shows no signs of failing; using a 1-c.p. lamp the lighting time would be increased to 25 hours.

WAGES IN THE ELECTRICAL CONTRACTING INDUSTRY.

A meeting of the Electrical Trades Union with the London Section of the National Federated Electrical Association (representing electrical contractors) took place on Wednesday, December 3rd, when the offer of the employers to bring London into the national scheme of standardised wages for the electrical contracting industry, by which London men would be paid 2s. per hour from December 1st, was unconditionally refused by the London Committee of the E.T.U.

The refused offer included certain allowances which, in the opinion of employers, would have the effect of increasing the men's earnings on the average considerably above what would have been obtained by the offer of June last, which worked out at 2s. 0¾d.

The rate in the electrical contracting industry in the London area, as a result of this refusal, therefore remained unaltered at 1s. 7d. per hour, plus 12½ per cent. on earnings, whereas the rates for the rest of the country have been agreed at 2s., 1s. 11d., 1s. 10d., and 1s. 9d. inclusive for the respective grades into which the country has been divided.

Under the circumstances, the employers, who considered that the deadlock caused by this refusal on the part of the men's executive would operate hardly on the rank and file who have had little or no part in the negotiations, and to whom some increase of the present rate is due, have decided that the inclusive rate of 2s. per hour for the London area shall be paid forthwith, and the rate for auxiliary workers over 21 shall be 1s. 7d. per hour.

According to the *Daily Dispatch* the contractors insist on the industry being an open one, that is, that they shall be at liberty to employ men who are not members of the union. On this point negotiations have been broken off, and now the officials of the union are threatening a series of "irritation strikes." By a ballot vote they have been authorised to call a strike when and where they will. Only the officials will know the day and hour of the first blow struck. There was a private meeting of the members of the union on Sunday last. Mr. Tom Mann was one of the speakers.

Interviewed by a *Daily Herald* representative, Mr. W. J. Webb, secretary of the London district of the E.T.U., said that the ballot, which ended on Saturday, was a ballot of the whole of the trade, and the Executive was now empowered to call out the 5,000 men directly concerned, or any of them, and to call out the other 10,000 electrical workers in London.

The London Executive was to meet on Thursday, and a mass meeting of the members will shortly be held.

Questioned in regard to the "blacklegs" and non-unionists for whom the employers were so anxious, Mr. Webb said that there were men in the trade who worked as blacklegs during the 1914 strike. Some of these were organised into the Association of Supervising Electricians, which was recently registered as a trade union, but which was not recognised by the General Federation of Trade Unions nor by the Trade Union Congress. The organisation, Mr. Webb said, was undoubtedly used by the employers as a weapon against the E.T.U. "The employers raised the question in June, when they offered us 2s. 0¾d. per hour on condition that we agreed to work with these men. We gave them until October 12th to join (or rejoin) the union at an entrance fee of 25s." Mr. Webb added that there had been cases of men having to pay as much as £100 to rejoin the union.

At a meeting held at York on November 27th, the National Joint Industrial Council for the electrical contracting industry unanimously agreed to recommend to the members of the E.T.U., the N.F.E.A., and the E.C.A. of Scotland the adoption of the following proposals:—

The standard rate of wages for the towns and districts in Great Britain and Ireland shall be as follows:—

Grade A: Rate 2s.: Towns and districts: Left open.

Grade B: Rate 1s. 11d.: Towns and districts: Mersey district, Manchester, and those towns or districts in Lancashire which have agreed or shall agree to follow Manchester rate; South Wales.

Grade C: Rate 1s. 10d.: Towns and districts: Belfast, Londonderry, Scotland, North-East Coast, Northumberland, Durham, Yorkshire, towns and districts in Lancashire and Cheshire which are not covered by agreement to follow Mersey district or Manchester rate, Carlisle, Eastern Counties (Lincolnshire, Norfolk, Suffolk, and Essex, and Herts outside London area), Nottinghamshire, Leicestershire, Derbyshire, Northamptonshire, Bournemouth, Plymouth, Devonport, Bristol, Birmingham, towns which agree to follow Birmingham rate, Coventry, Wolverhampton, Potteries.

Grade D: Rate 1s. 9d.: Towns and districts: Remaining towns and districts other than London in England and Wales.

The above rates include the 12½ per cent. and all past and future awards up to March 1st, 1920, and are to be standard rates, and shall not be altered except in accordance with this agreement.

The new rates were to take effect as from the pay day in the week ending Saturday, December 6th, 1919, and to be payable in respect of the pay period for which payment was made on that pay day, provided that where earlier dates had already been agreed locally, such earlier dates should be substituted for that given above, and that where the increase in any district exceeds 3d. per hour, the increase payable as above shall be 3d. only and the balance of such increase shall come into effect six months later.

Any variation in the above general rates to be a national variation, and to be applied to all grades.

A town or district may only alter its grade by local agreement, or by decisions of the N.J.I.C. failing local agreement.

After March 31st, 1920, there will be a review of wages in February and July of each year.

An application having been made by the Mersey D.J.I.C. that the rate for the area covered by that Council should be 2s. per hour, it was agreed to transfer those towns and districts which are subject to the Mersey agreement from grade B to grade A.

The agreement applies to all qualified journeymen being members of the E.T.U. who are employed by electrical contractors in districts covered by the agreement, except such employés as may be engaged for full time on manufacturing work under agreed engineering conditions.

LEGAL.

YATES *v.* ROBT. BOWSON & CO., LTD.

At Newcastle-on-Tyne County Court on 3rd inst., before his Honour Judge Greenwell, Ellen Yates, of Gateshead, made an application under the Workmen's Compensation Act against defendants, of Newcastle, in respect of the death of her husband, Francis Yates, on June 10th. Mr. H. S. MUNDAHL, for the applicant, said that Yates was killed while following his employment as a painter. Deceased earned £5 12s. in five days. On the day of his death he was painting an electric crane at Messrs. Palmers' works. About 9 p.m. his body was found hanging over some cabin rails. He had been electrocuted.—THOMAS KINGDOM, a crane-driver, said he warned the deceased about hanging his paint pot over some wires. Those wires carried current, but were then not alive.—A. E. DENNY, who found the body, said he thought Yates had overbalanced himself, and, in putting out his hand to steady himself, had touched a live wire.—Mr. E. MEYNELL, for the defence, said the deceased had no right to be painting there when the wires were alive.—Mr. METCALFE, manager for the defendant company, said Yates was warned not to go near the crane unless he was informed by the electrician that the current was off. He was not authorised to work on the night of his death.—Other witnesses gave evidence that Yates had been warned.—His HONOUR said the deceased had disregarded the warnings given to him, and found in favour of the respondent company.

LONGBOTTOM & FARRAR, LTD., *v.* THE B.E. COMPANY (OF LONDON & BIRMINGHAM), LTD.

On December 3rd, in the Commercial Court of the King's Bench Division, Mr. Justice Roche heard an action brought by plaintiffs, of Keighley, Yorks, against defendants, of Mansion House Chambers, Queen Victoria Street, London, the plaintiffs' claim being for the price of goods sold and delivered.

Plaintiffs' case was opened by Mr. CARTWRIGHT SHARP, who said the action was brought to recover the balance of the price of certain brass adaptor pins which counsel explained were used in connection with electrical work. The defences appeared to be three. There was first of all the defence that the defendants were entitled to 2½ per cent. discount, but the two main defences were that the defendants said they were entitled to reject the goods because they were out of time, and they further said they were entitled to reject the goods because they were not up to sample in one respect, and that was they were incomplete, a small screw being missing. With regard to discount, he said the defendants were not entitled to any. With regard to the plaintiffs being out of time, he said if reasonable time had elapsed, then obviously it had been extended by the conduct of the parties as appeared in the correspondence, and so far from accepting the goods, defendants accepted them, and only tried to reject at a very late stage. With regard to the goods being incomplete, plaintiffs had difficulty in obtaining these little screws. Defendants said they would get them for the plaintiffs, and since they did not get them for the plaintiffs, and could not send the right screws, practically by agreement, plaintiffs sent the adaptor pins without these little screws.

Mr. HARNEY, for the defendants, said clearly they ordered the adaptor pins complete, and the screw was a very important part of the goods.

His LORDSHIP gave judgment for the plaintiffs for £353 9s., with costs.

THE ELECTRICITY SUPPLY BILL.

On Wednesday, December 3rd, the Bill came up for second reading in the House of Lords, and was recommended to the House by the Lord Chancellor as one which had been the subject of exceptional care and deliberation, and was supported by the expert advisers of the Government. Lord Downham raised no objection to the principle of the Bill, but attacked it on financial grounds, and said that if the present undertakers were justly treated they would reorganise the system of supply. Lord Moulton regarded the Bill as nationalising the industry, opposed it as untimely and unwise, and declared that it was based upon a retrograde policy. Viscount Midleton suggested that the Bill should be referred to a Select Committee, and the debate was adjourned.

On Monday Viscount Haldane supported the Bill as a means of increasing production; Lord Inchcape, Lord Erskine, the Marquis of Salisbury, and Lord Parmoor opposed it as an attack on private enterprise; Lord Emmott and Lord Ashton thought the Bill was premature. In reply, the Lord Chancellor suggested that with the exception of Lord Haldane, none of the speakers had taken the trouble to read the Bill; they merely repeated what Lord Moulton said. The assumption that the Bill would cost 150 millions had not the slightest foundation. The Bill was the outcome of the deliberations of several committees of exceptional ability, with regard to the shortage of coal, and was directly based on the report of one of them. Not one penny would have to be found by the State. The Bill did not mean nationalisation, and as for the danger of sabotage, no line would be as long as 40 miles. Gas mains would be more liable to damage. The electricity supply industry was at a standstill pending the passing of the Bill, which the Government regarded as vital to the scheme of reconstruction.

The Bill was read a second time.

BUSINESS NOTES.

The Price of the "Electrical Review."—Owing to the continually increasing cost of all production charges, we are obliged to advance the price of the ELECTRICAL REVIEW from 4d. to 6d. from the first number of the New Year—January 2nd, 1920. We wish to direct our readers' attention to the notice regarding the matter which appears on the first Leader page in this issue. The new subscription rates are there stated.

The Christmas Holidays.—We shall be glad if contributors and advertisers will take note that the issue of the ELECTRICAL REVIEW for Friday, December 26th, will be published on Wednesday, December 24th. The Advertisement Department announces that new copy and alterations to existing displayed advertisements should be received not later than *Thursday morning* next, December 18th. Official Notices and small prepaid advertisements can be received up to 5 p.m. on Monday, 22nd inst.

Contributors and correspondents are asked to note that all editorial matter must be received two days in advance of the usual time.

The Lead Market.—Messrs. James Forster & Co., reporting on December 6th, state :—

The turnover this week is 12,000 tons, about equally divided over the five market days. The closing price yesterday was at £40 5s. for practically all positions, a rise on the week of about 50s. per ton, which compares with £25 10s. early October and £23 July, a rise unparalleled in the history of the trade. The Government price throughout the week has been well over the market, and to-day is £40 15s. delivered, with an embargo for export. That the enormous advance is largely due to speculation by outsiders is true, but it has been helped by the absence of supplies from Spain (which country has never before failed to give us a constant and very large proportion of our requirements) combined with the disastrous strike in Australia, which has held up the largest producing mines in the world for over seven months and still continues. These two features account for the rapid depletion of the huge stock held by the Government here and in Australia six months ago. The future is one of anxiety to all connected with the trade, and it is impossible to see where effective relief can come from.

Messrs. G. Cawson & Co. report as follows :—

The trend of the market throughout the week has been constantly upwards, culminating in the unprecedented prices being paid of £40 2s. 6d. for December and £40 5s. to £40 7s. 6d. for February and March. This figure is by far the highest known for more than fifty years, and is about 170 per cent. dearer than the average prices of the three years prior to the war. How much longer speculators may be disposed to operate at present high prices it is difficult to pregnosticate. The present inflation seems partly to arise from the delay in delivery of lead by the Government, who have very large quantities sold, but buyers are unable to obtain the lead and thus have to operate on the market to fulfil their engagements. The positions with regard to future supplies so far shows no improvement. The rate of exchange is operating against fresh imports from America. Apparently there is more freight now offering from Australia, and this will tend to help the situation. The position in Spain is difficult to understand—we ought now to be receiving considerable shipments from that country. The high price of silver combined with almost a record price for lead must eventually cause a larger production. So far, however, there are few signs of any developments in this direction. The outlook is still obscure. Speculators, however, may still be able to drive the price higher, but it is difficult to say whether consumers will eventually take the lead off their hands, as after all consumers have to say the final word as to price. Caution in buying seems to be more than ever necessary at present inflated prices.

Messrs. James & Shakespeare report that the price of English pig lead on Tuesday, December 9th had advanced to £41 10s., an increase of 30s. for the week.

A Leyton Contract.—The Leyton Electricity Committee has received a letter from MESSRS. BRUCE PEEBLES & CO., LTD., dated October 28th, stating that owing to the increased cost of manufacture since the date their tender was submitted, the price must be increased by £125 per machine on the two machines ordered, and that the delivery time must be increased from seven to nine months from receipt of instructions to proceed. At the time the estimate was made copper was £90 per ton; it is now £122. Other commodities have also further increased, consequently a supplementary loan at conclusion of works will be requisite. As some regulating resistances equivalent to £60 mentioned in the tender will be best supplied with the switchboards, Messrs. Bruce Peebles' new contract figure is £6,315, instead of £6,125. The Committee has agreed to the increasd price and extended period for delivery, as mentioned.

Dutch and American Interests.—The shareholders in the N.V. Philips' Gloeilampen Fabriek of Eindhoven will meet in extraordinary general meeting this week for the purpose of considering a proposal to increase the share capital to £1,666,000. It is stated that the object of this expansion is to enable an interchange of shares to be effected with the International General Electric Co. and the General Electric Co. of New York, with which the directors of the Dutch company have concluded a community of interests which, among other matters, will permit of an exchange of patents and experience.

A Western Electric Function at Woolwich.—An interesting function, attended by over two thousand people, was held at the Drill Hall, Woolwich, last Friday evening on the occasion of the presentation of gold service badges to those employés of the Western Electric Co. who had been on the pay-roll for 10 years and over. For 10 years' service a simple badge was presented, and for each completed additional five years a star is added. Musical selections were rendered by the Royal Artillery Band. At the conclusion of the musical programme, Mr. H. M. Pease, the managing director, took the chair. He intimated that the directors had decided that service with the Colours should count both for service badges and for pensions. He called attention to the fact that 10 years ago there were 958 employés on the company's pay roll, and the badges which were being presented that night indicated that one fourth of those remained in the company's employ to-day, a record of which any industrial company might well be proud. He stated that briefly in general the method of operation of the pension system was as follows:—Every employé at the age of 60 years with continuous service extending 20 years or more would become eligible for a pension of 1 per cent. for each year of service of the average salary of his last ten years of employment. Under certain other conditions, pensions might be granted on the recommendation of the board of directors. He was pleased that Mr. J. E. Kingsbury had undertaken to present the badges, for he reminded them that the company's business was started by Mr. Kingsbury in 1883, when his staff consisted of one man and a boy. Mr. Kingsbury, in the course of his speech, said the circumstances were such as to encourage reminiscences, but in view of the later proceedings of the evening, to which they were looking forward, he would resist that temptation and content himself with reminding them that with their present development of departments, scientific and technical staff, they would realise that there was some difference between present conditions and those which obtained when one individual was draughtsman and salesman and had at the same time to explain to others the underlying principles and advantages of new scientific developments. It was good that the company should continue to have the benefit of the accumulated experience which the employés gained in its service. Regarding the pension scheme, so far as he was aware it differed materially in two main particulars from those generally in force. As a rule pensions schemes were contributory; that was to say, the employés contributed a certain amount and the employer added something more. Secondly, pension funds were generally confined to staff officers or those in receipt of salaries. The Western Electric system was non-contributory so far as the employé was concerned, the funds being furnished entirely by the company, and it applied to every employé—whether president or porter—and was computed exactly in the same way for all. As he had refrained from dwelling on the past, so he would not detain them as to the future, except to remark that the company's future depended very largely on the future of the world at large. In the reconstruction it was their products which would largely contribute to those material improvements in standards of life which were being sought. There were pessimists as to the world's outlook and their country's outlook, but for his part he had no difficulty in taking an optimistic outlook in general, and so far as this country was concerned he had too great a confidence in the sturdy common-sense of the people to take a pessimistic view, so that he believed that as the company had had an honourable past, so might they look forward to a long and prosperous future. Mr. Kingsbury and Mr. Pease then presented gold service badges to 250 of the employés who had served with the company continuously for 10 years or over. Following this there came the programme of 12 dances played by the Royal Artillery Band, thoroughly enjoyed by everybody. Refreshments were provided throughout the evening. For the successful manner in which the gathering was organised credit is due to the arrangement committee, consisting of Messrs. H. M. Pease, R. L. Diemer, J. F. Barbour, F. Martin and G. C. Goodburn.

B. I. & H. C. Staff Guild Rules. — At a meeting o about 300 members of the staff of the British Insulated and Helsby Cables, Ltd., on October 27th, a set of rules for the Staff Guild was unanimously adopted. We understand that at least 85 per cent. of the members of the staff have joined the Guild, which is believed to be the first of its kind in an engineering firm; while the Guild affords a convenient channel by which the staff can bring to the notice of the directors any matters which need attention, the main principles of the Guild are "Citizenship and Service"—the two qualities of which the country is so greatly in need at this time. We give below such extracts from the rules as appear likely to be of interest to the staffs of other firms:—

2. *Objects.*—The objects of the Guild shall be:—

(*a*) To promote in every way the prosperity of the staff, whilst fully recognising that the interests of the company and the staff are mutual.

(*b*) To afford a means of communication between the staff through the committee of the Guild and the directors of the company through the management, on any subject concerning the welfare of the staff, but the freedom of each staff member shall not be fettered in his negotiations with the company in regard to his salary or conditions of employment.

(*c*) To promote social and educational intercourse amongst its members.

(*d*) To make arrangements with tradesmen and others for special discounts to be granted to its members.

3. *Qualification for Membership.*—Members of the staff above 19 years of age are eligible for membership of the Guild. Members of the staff between 16 years and 19 years of age may join as junior members, but shall not be entitled to vote at a general meeting, nor be eligible for election to the committee.

6. *Subscription.*—The expenses of the Guild shall be met by an annual subscription, which shall be 2s. 6d. for each member and 1s. each junior member.

8. *Management.*—The business of the Guild shall be managed by a committee, consisting of 15 members (including the chairman), constituted as follows: Managerial staff, one member; Prescot—heads of departments, one member; technical staff, assistant superintendents, and draughtsmen, one member; foremen and assistant foremen, one member; clerks, typists and persons unclassified above, four members; all members of the contract department outside staff, one member; Helsby (five members on similar basis); all members at branch offices, one member. The committee shall elect the chairman and appoint an honorary secretary and an honorary treasurer at the first meeting held after the annual general meeting in each year.

10. *Retirement of Committee.*—Seven or eight members of the committee (five Prescot and outside departments and two or three Helsby) shall retire at the annual general meeting in each year, but shall be eligible for re-election. The members shall retire in rotation after serving two years on the committee.

12. *Committee Meetings.*—Meetings of the committee shall be held at intervals of not more than two months. Reasonable out-of-pocket expenses of the members attending the meetings shall be paid out of the funds of the Guild.

15. *Annual General Meeting.*—The annual general meeting of the Guild shall be held in the month of October in each year.

16. *Special General Meetings.*—A special general meeting of the Guild shall be called within twenty-one days after receipt by the secretary of a written request, with notice of motion, signed by at least one-third of the members.

17. *Quorum at General Meetings.*—One hundred members of the Guild shall constitute a quorum. Members of the Guild residing ten miles or more from the place of meeting, or absent on the company's business, may record their votes by post.

22. *Interpretation.*—The term "member" used throughout these rules shall be deemed to include both male and female.

The directors have approved the formation of the Staff Guild.

Electrical Supplies in South Africa.—The *S. African Mining and Engineering Journal* for November 8th stated that the tubing scarcity had been relieved by the arrival of considerable consignments, and it was estimated that with the tubing then on hand, together with shipments shortly expected, electrical dealers' wants in that respect would be satisfied till about next March. "It is stated that there are no ceiling roses in the country. These, which cost in pre-war days 2s. 6d. a dozen, are now selling at 15s., having risen from 6s. a dozen within a week. . . . . The scarcity in this article is likely to last for some considerable time, and will be the means of giving our Japanese friends a chance to cut into our market. As illustrating the way in which an article may move in these days when it is in demand and at the same time scarce, a well-known dealer mentioned that he had recently on hand a few gross of low-tension ceiling roses, which had originally cost him 25s. a gross, but which, on account of their having become almost obsolete he had written off in his profit and loss account. Owing to the present dearth of these articles he had quite recently disposed of them at 75s. a gross."

Japanese-American Aluminium Company.—Representatives of an American aluminium concern have recently arrived in Japan, according to the Press, to confer with Japanese aluminium interests in the formation of a company, the proposed capital of which is yen 10,000,000, the Americans to take one-half the shares and the Japanese the other half. The parties are in negotiation with the Japanese Government for water-power rights in Toyama Prefecture. The American company, having agreed to transfer to the Japanese company all its manufacturing rights and technical experience, does not wish that the shares to be offered in Japan should be open to public subscription.—*Board of Trade Journal.*

National Insurance. — The Ministry of Health draw attention to the fact that any non-manual worker whose remuneration is at a rate between £160 and £250 a year and who desires to claim exemption under the National Health Insurance Act, 1919, should make his claim not later than December 31st, 1919. The appropriate form of application is obtainable at any post office. Until exemption has been granted the weekly contributions required to be paid in respect of the employed person are at the ordinary rate (7d. for men and 6d. for women), and if exemption is not claimed within the time allowed the person will thereafter remain subject to compulsory insurance under the normal conditions.

Book Notices.—*The Electrical Power Engineer* for November contains a full report of the proceedings of the Federal Council of the Federation of Technical and Scientific Professional Associations at the meeting on October 11th. The "original members" of the Federation are the British Association of Chemists, the Electrical Power Engineers' Association, the Electricity Supply Commercial Association, the National Association of Industrial Chemists, the National Association of Supervising Electricians, the National Union of Scientific Workers, and the Society of Technical Engineers. The arbitrator's awards in differences between the E.P.E.A. and the Corporation of Sunderland, the Charing Cross Co., and the Metropolitan Borough of Woolwich are given in full.

"The Hardware Trades Directory." First edition. 1919. London: 7, South Street, E.C. 2. 5s. 9d. net.—This directory contains between 120 and 130 pages of names, alphabetically arranged, with addresses and telegraphic addresses and telephone numbers of firms connected with the hardware, electrical machinery, and allied trades. A classified buyers' guide follows, also an index of "branded goods, specialities, and proprietary articles."

On October 1st, in spite of the strike still in progress in New York City, *Chemical and Metallurgical Engineering* began to appear weekly instead of semi-monthly. This event is significant of the great developments which are taking place in the United States in the industries covered by our highly-esteemed contemporary, from whose pages we have often quoted freely, and we tender our congratulations to the management on the consummation of a plan which it has long had in contemplation.

We have received a copy of a new monthly illustrated paper (1s.) the *British Manufacturer*, which is being issued under the auspices of the *Illustrated London News*. It is produced in high-class style, and its principal object is stated to be to conduct propaganda throughout the world in the interests of British products.

"Telephony Without Wires." By P. R. Coursey. Pp. xix + 414; 249 figs. London: The Wireless Press. Price 15s.

"Alternating-Current Work." By A. Shore. Pp. ix + 163; figs. 86. London: Wireless Press. Price 3s. 6d. net.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVIII, No. 11. November, 1919. New York: The Institute. Price $1.

"Science Abstracts" (A. & B.). Vol. XXII, Part 11. November 29th, 1919. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each.

"Memorandum on Combines and Trade Organisations." By J. Hilton. London: Harrison & Sons. Price 1s. net.

"Calculation of Electric Conductors." By W. T. Taylor. Pp. vi + 34; 4 figs., 11 tables, and calculating chart for electric cables. London: Constable & Co. Price 10s. 6d. net.

"*Transactions* of the Engineering Institute of Canada." Vol. XXXII. Parts I and A. Part I consists of a series of papers presented to the Institute in 1917, 1918, and 1919 descriptive of the Quebec Bridge; Part A, plates accompanying the text. Montreal: The Institute.

"A First Course of Electric-light Switching and Testing." Arranged by W. Perren Maycock, M.I.E.E. Second edition. London: A. P. Lundberg & Sons. Price 10d. post free.

State of German Electrical Industry.—According to an interview given to the Berlin newspaper *Der Tag* by one of the directors of the "A.E.G." (Allgemeine Elektricitäts Gesellschaft), the electrical industry in Germany appears to be in a very bad way. The home trade is stagnant, and the few orders in hand are being held up by labour troubles. The state of the export trade is, if possible, even worse: doubts as to delivery cause new buyers to hold back, orders already placed have been cancelled by Norway and Sweden, which are themselves beginning to manufacture, and this valuable outlet will in future be closed to Germany. Orders from Holland and Finland are being transferred to Switzerland and France; America is capturing the Danish market in lamps and meters; France and England are more hostile than ever. Germany, the interviewer was told, is a sick man in danger of a mortal relapse, which will inevitably supervene unless Labour comes quickly to its senses.—*The Mining Journal.*

Foreign Trade.—November Figures.—The following are the electrical and machinery figures given in the official returns of imports and exports for November:—

	November, 1919.	*Inc. or dec.*	11 *months*, 1919. *Inc. or dec.*
Imports.	£	£	£
Electrical goods, &c. ...	49,759	− 40,747	+ 73,633
Machinery	813,639	− 213,172	+ 3,445,751
Exports.			
Electrical goods, &c. ...	708,802	+ 564,489	+ 3,259,177
Machinery	3,764,303	+2,552,713	+13,965,767

Workmen's Compensation.—In the House of Commons, on December 5th, the Workmen's Compensation (War Addition) Amendment Bill passed second reading. The Bill is a temporary measure to increase the percentage of compensation payable under the Compensation Act of 1906 from 25 to 75 per cent., in order to meet the increased cost of living. The Bill will operate during the period of the war and six months afterwards. The whole question of compensation is now under consideration by a Departmental Committee, which, it is hoped, will report in time to allow permanent legislation to be brought in in the course of next year.

Catalogues and Lists.—The Metropolitan-Vickers Electrical Co., Ltd., 20, Brazennose Street, Manchester.—Publications Nos. 7,450/1, Metropolitan-Vickers Rateau Reducing-pressure Steam Turbine, and 7,782, Static Transformers for use with electric furnaces; leaflets descriptive of mixed-pressure steam turbines, reversing planer equipment, type B.B.H. oil switch, transformers for use in collieries, type BB 7 oil switches, automatic voltage regulator, furnace transformers, truck-type switchgear, type "S" oil-break switch-pillar, "flexible" unit-type control gear, brake solenoids for A.C. circuits, frequency meter (type F), type SB ammeters and voltmeters, type N A.C. watt-hour meters, shell-type transformers, and core-type transformers.

Messrs. H. H. Robertson & Co., Pittsburg, U.S.A.—Leaflet describing "Robertson Process Metal."

Simoon Engineering Co., Ltd., Bramber Road, W. Kensington, W. 14.—Priced and illustrated catalogue of D.C. electric motors.

Enterprise Manufacturing Co., Ltd., Gun Street Electrical Works, Bishopsgate, E. 1.—Card giving dimensions and prices of conduit-box fittings.

Messrs. Ed. Bennis & Co., Ltd., 28, Victoria Street, S.W.—A reprint from *Engineering* describing the coal-handling appliances installed at the Coventry Corporation electricity works.

Messrs. Electra, Ltd., Rupert Court, W. 1.—Leaflet on the half-watt lamp.

The General Electric Co., Ltd., 67, Queen Victoria Street, E.C. 4.—Installation Leaflet M 12, showing the electrification of a motor-car, aero-engine, and aeroplane works. New price list (publication OS 2 255) of Osram lamps, vacuum type and Atmos type. On the cover is a striking coloured design showing a huge arm and hand coming through the clouds and holding an Osram lamp over London, as seen by night. Posters and showcards will soon be available for the trade, making the design familiar to the public.

The Overseas Engineering Co., Ltd., 75, Curtain Road, E.C.—Lists Nos. 33, 43, 57 and 135, describing and illustrating electric bells, vacuum cleaners, a safety water-heating device, and the "Overseas" electric lighting outfit.

The Brush Electrical Engineering Co., Ltd., Falcon Works, Loughborough.—An illustrated reprint from *Engineering* descriptive of the two 1,000-kw. motor-generator sets installed by the company at the Kingston-upon-Thames power station.

Messrs. Drake & Gorham, 67, Long Acre, W.C. 2.—Pamphlet No. 272, an illustrated price list chiefly devoted to electric fires, including the "Belling," "Revo," "Arora," "Angelus," and "Elite" types. A number of ornamental and "bowl" fires also appear. Several other domestic electrically-heated devices are listed, comprising toasters, liquid heaters, kettles and irons. Space is also given to illustrations of electrical hair-dryers and vibrators.

The India-Rubber, Gutta-Percha, and Telegraph Works Co., Ltd., Silvertown, E. 16.—List No. 31, "Silvertown Primary Batteries." A handsomely produced catalogue of primary cells of many descriptions. The bulk of the list is illustrative of various forms of the Leclanché cell adapted to special uses. Component parts possessing special properties are described, including several types of non-encrusting zincs. The Leclanchés are made up into a number of batteries, to which many pages are given. The list shows, in addition, a special improved type of low-resistance cell, and also bichromate, Bunsen, Daniell, and Grove patterns. Several dry cells are included in the list, and charging materials, &c., also appear.

The Glass Trade.—The present position and future prospects of the glass trade were explained by Mr. W. Bradford, General Financial Secretary of the National Flint Glass Makers' Society, at a meeting of the members of the Union at Dudley, on Saturday. He stated that before the war, with the exception of two firms manufacturing electric lamps, practically no electric lamp bulbs were produced in England. Now upwards of 1,000,000 bulbs per week, together with the necessary tubing and rod, were being produced, and the requirements of the country were being fully met by home manufacturers. Several plants were being installed, which would, if necessary, greatly increase the weekly production, and there was no doubt that manufacturers could amply meet both home requirements and the requirements of all the export trade they could secure. It would be a catastrophe if the employment which this new industry provided for some thousands of workpeople were jeopardised by the unfair competition of foreigners receiving incomparably lower wages, and working under much less satisfactory conditions.—*Birmingham Post.*

Wages in the Post Office.—At a meeting of the E.T.U., at the Memorial Hall, it was stated that skilled workmen in the Post Office service were receiving a minimum of £3 0s. 5d., and a maximum of £3 13s. 5d., as against £4 5s. paid to workers in private employment.—*Daily Herald.*

Calendar.—The "Z" Electric Lamp Manufacturing Co., Ltd., of Southfields, London, S.W., have issued a neatly-designed calendar. A block of circular date-slips for 1920 is fixed in the bottom portion of a "Z" lamp bulb, which is printed on an oval card for hanging. Members of the trade who have not received copies can have one on application while the supply lasts.

A Siemens Visit to Canada.—The *Canadian Electrical News* for November 15th states that Messrs. F. H. Leonard and W. B. Hopkins, of Siemens Bros. & Co., Ltd., London, have been on a visit to Canada, in connection with their tour of the world investigating trade conditions. Messrs. Leonard and Hopkins report that there is a very large demand for electrical equipment of all kinds throughout the world, especially in South America.

Trade Announcements.—Messrs. Worssam & Edwards, electrical engineers and contractors, have opened new premises at 302, Upper Richmond Road, East Sheen, S.W.

Mr. M. St. J. C. Shepherd, of Westbourne Grove, Westcliff-on-Sea, has taken up the representation of Messrs. Pillatt & Co., Ltd., of Stapleford Ironworks, for the sale of their "Perfect-Combustion" furnaces.

The Monometer Manufacturing Co. (1918), Ltd., have removed their works from Whitehouse Street to Browning Street, Birmingham. Telephone No.: "Midland 553"; telegraphic address: "Monometer," as before. The Monometer Co. are also the proprietors of the Griffin Ironworks and Albion Foundries, Browning Street, Birmingham. Telephone No.: "Midland 553"; telegraphic address: "Cupola," Birmingham. The railway siding for the Monometer Works and foundries is Monument Lane Station, L. & N.W. Railway, and their canal siding is on the Staffordshire canal.

The plant, machinery, and stock in trade of the British Willard Battery has been purchased from the United Motor Industries, Ltd., Poland Street, London, W., by Mr. George Gregory, of 90, High Street, Camden Town, N.

The Crypto Electrical Co., Ltd., of Willesden, wish to assure our readers that if the Exchange states that their telephone does not reply to calls between the hours of 9 a.m. and 5.45 p.m., it is guilty of a terminological inexactitude. An operator is exclusively in charge during the whole day. Further, in order to give prompt service, there has been installed an additional line, making four in all, with eight internal extensions.

The Suffolk Electricity Supply Co., Ltd., which has for years been carrying on business in Norfolk, and which has recently extended its activities into Essex, has changed its name, and is now registered as "East Anglian Electricity, Ltd." The authorised capital has been increased to £100,000.

Plant for Disposal.—The Reigate T.C. has for sale a second-hand vertical high-speed compound engine, by W. H. Allen, Son & Co., and one 2,500-volt single-phase alternator, by the Electric Construction Co. For particulars see our advertisement pages to-day.

Commercial Motor Vehicles.—In their report, just issued, the directors of John I. Thornycroft & Co., Ltd., state that the business offering for commercial vehicles and marine motors is more than the company is able to cope with. The difficulty at the present moment is to find a means of increasing the output without unduly raising prices or diminishing the standard of work.

A New Swedish Cable Factory.—The directors of the A.B. Svenska Maskin Verken propose to reorganise the works by its conversion into a modern factory for the production of electric cables. At a recent meeting of the company, when the scheme was discussed, a committee composed of six shareholders was appointed to co-operate with the directors with a view to the realisation of the project.

Italian Copper and Aluminium.—To electrify Italy's 6,000 kilometres of railways, the greater part with twin tracks, it will require, says the Italian engineer, Augusto dell'Amore, 30,000 kilometres of copper wire, which, owing to its scarcity, stands at a prohibitive price. Italy is poor in deposits of copper, but possesses vast beds of bauxite in Marsica, Sanio, Friuli, and Istria, which, in the first-named district, is now being converted into aluminium, proved in practice in America, France, and elsewhere to be an adequate substitute for copper. Therefore, why not develop our native supplies? asks the Italian expert. To treat the bauxite, great electric power is required, but, fortunately, in all the districts named ample water power is available in the shape of vast mountain-lake basins and waterfalls up to 1,000 metres in height. "The prospect is alluring," says our contemporary *L'Italia Elettrica*, "but we are very far from that development necessary to render us completely independent in this important industry."

New B.T.-H. Factory.—It is stated that representatives of the British Thomson-Houston Co., of Rugby, have been negotiating for the acquisition of the Government cartridge factory at Cakemore.

French Electrical Companies.—The Compagnie Lorraine pour l'Eclairage Automatique des Wagons par l'Electricité, which is working the Vickers patents in France, has just secured a contract to equip over 300 passenger coaches for the Chemin de Fer du Midi. It is hoped that the Vickers patents will yield as favourable results in France as they have in the United Kingdom.

With a view to carrying out its programme of extensions, the Energie Electrique du Littoral Méditerranéen is contemplating raising its capital from 60,000,000 to 100,000,000 fr.

A concern styled Compagnies Reunies de Gaz et de l'Electricité, Lyons, although owning only the modest capital of 500,000 fr., has just absorbed 13 other companies, whose aggregate capital—formerly 9,922,500 fr.—is now enlarged to 31,599,500 fr., or a total capital of over one and a quarter million pounds. These companies serve the cities and towns following:—Angoulême, Commentry, Montauban, Besançon, Aix (Bouches-du-Rhone), Cognac, Royan, Puy, Bourg, Perpignan, Auch, Chambéry, and Orange. Economy of management and extensions are presumably the objects of these absorptions.

The Société de Signalisation de Chemins de Fer (Cousin and César patents) has gone into voluntary liquidation. The Forces Motrices du Bens, of Grenoble, has likewise decided on liquidation.

The Science Exhibition at Glasgow.—At this Exhibition, Messrs. Electric Control, Ltd., are showing two large enclosed-pattern air-compressor controllers, both of the contactor type, one for a D.C. supply and the other for an A.C. three-phase supply. The method of control is the standard arrangement adopted by this firm, enabling the motor to be started and stopped automatically at the minimum and maximum pressures respectively. A pressure gauge of the Bourdon tube pattern is provided for this purpose, working in conjunction with a relay, which relieves the contacts of the gauge of any sparking and burning. The provision of a magnet-operated pilot valve, which works in conjunction with the inlet unloading valve on the air compressor, enables the compressor to be unloaded during the starting period, and again at stopping, effecting a considerable saving in the wear and tear of the plant. A hand change-over control switch is fitted, which allows of automatic starting and stopping, as described above, or running continuously, the compressor unloading at maximum pressure.

Two large D.C. reversing contactor controllers are shown, which are used for D.C. reversing motors, on a double-leaf bascule bridge, and there is also shown the firm's patent automatic eddy-current rotor controller; this controller has no moving parts, therefore no upkeep costs, and can be used in the rotor circuit of a three-phase slip-ring induction motor, without any switchgear, and for such duties as lifts, plate-edge planers, straighteners and benders, and live rolls.

Messrs. Brook, Hirst & Co., Ltd., Chester, are showing some of their latest pillar-type motor-starting panels. The various combinations cover a range from a standard face-plate starter with D.P. main contactors, overload and no-volt releases, and isolating switch, to their multiple-lever controller, fitted with D.P. main contactors, overloads, no-volt releases, and with shunt regulators, both of the radial-arm pattern and of the parallel-movement pattern.

Messrs. Erskine, Heap & Co., Ltd., Manchester, show a typical oil-switch unit and cast-iron base, such as are used in collieries, rolling mills, steel works, and shipyards. This switch includes all their up-to-date attachments having overload and no-voltage releases, bus-bar chamber with isolating chamber and gear complete, with trifurcating boxes. A similar high-class oil-break switch is shown arranged for wall mounting, as well as their ironclad water-tight switchgear, with fool-proof interlocking between the handle and the door of the cases, and various accessories.

Patents and Designs Bill.—On December 5th the Patents and Designs Bill passed the Committee Stage, and was reported to the House of Lords.

The Industrial Court.—It was announced in the daily Press on Saturday last that, in pursuance of the Industrial Courts Act, to which we alluded in our Leader last week, the Minister of Labour had appointed the following to be members of the first Industrial Court, to which trade disputes may, with the consent of the parties concerned, be referred for settlement by arbitration:—

President.—Sir Wm. W. Mackenzie, K.C.

Chairman.—Mr. F. H. M'Leod.

Members.—Mr. D. C. Cummins, Mr. J. M'Kie Bryce, Mr. Ernest J. Brown, Mr. F. S. Button, Miss Violet Markham, and Miss Cecile Matheson.

Other chairmen and members will be available to form additional divisions of the Industrial Court if this should be found necessary, in order to ensure adequate provision for the prompt decision of matters referred to the Court; and the Court will also be in a position to depute individual members of the Court to hear cases where the parties desire a speedy local hearing, and where the case is one which can suitably be heard by one member of the Court.

In accordance with the provisions of the Industrial Courts Act, trade disputes, whether existing or apprehended, may be reported to the Minister of Labour by, or on behalf of, either of the parties to the dispute, and the Minister will thereupon take such steps as seem to him expedient for promoting a settlement of the dispute, whether by way of conciliation, or ultimately, if the parties consent, by arbitration.

Where arrangements for the settlement of disputes exist in any trade or industry as a result of agreements between employers and workpeople's organisations, it will be the duty of the Minister to see that such means of settlement have been utilised before the dispute is referred to arbitration.

In addition, the new Act will continue the practice under which the Minister of Labour has appointed single arbitrators or *ad hoc* Boards of Arbitration consisting of representatives of employers and of workpeople, nominated by the parties to the dispute, with an independant chairman appointed by the Minister of Labour.

Copper Prices.—Messrs. F. Smith & Co. report, December 9th:—Electrolytic bars, £110, £1 increase; ditto, sheets, no change; ditto, wire rods, £125, £1 increase; ditto, H.C. wire, 1s. 3½d., ½d increase. Messrs. James & Shakespeare report, December 9th:—Copper bars (best selected), sheets and rods, £147, £3 increase.

Dissolutions and Liquidations.—Malta Tramways, Ltd.—Meeting called for January 13th, at 4B, Frederick's Place, Old Jewry, London, E.C., to hear an account of the winding-up from the liquidator, Mr. W. Elles-Hill.

H. G. Hoad, electrical and mechanical engineers, 36, St. Martin's Court, Charing Cross Road, W.C.—Mr. V. Gascoigne and Mr. H. G. Hoad have dissolved partnership. Mr. H. G. Hoad will attend to debts.

German Trade Union Members.—Since the Armistice the number of members of Trade Unions in Germany has risen to 7,000,000.—*Financial Times.*

Retail Traders—The Licence System to End.—A provincial paper quotes Sir Robert Horne as stating that the system of licences for retail traders will end on December 31st.

Steam Plant for Sale.—Birmingham Corporation Electricity Supply department has for disposal two Ferranti vertical cross-compound engines, one surface condenser, one ejector condenser, two 500-KW., 500-volt D.C. generators. For particulars see our advertisement pages to-day.

Institute of Commerce at Brussels.—We read in the *Daily Telegraph* that the Commercial Committee of the House of Commons has approved the suggestions made through the Belgian Government to the British Foreign Office for the establishment of an institute of commerce in Brussels on lines similar to those agreed upon before the war. The Palais D'Egmont has been offered for the purpose, and will provide ample accommodation, including a room for the use of each nation represented. Among the objects of the institute will be to collect information and statistics relating to trade, and make them available for members from all countries, and also to prepare a digest of commercial law in all the nations concerned.

LIGHTING AND POWER NOTES.

Birkenhead.—LOAN.—The T.C. is to seek a loan of £12,500 for electric meters needed in connection with the housing scheme.

Blackpool.—MAINS EXTENSIONS.—It is proposed to expend £30,000 on new feeder mains, distributors and services. An application for borrowing powers is to be made to the M. of H. There are to be extensions of mains in several districts. The details are:—15,000 yards new feeder mains and distributors, £15,750; 2,000 new services, £8,000; four new sub-transformers and switchgear, £2,000; miscellaneous and contingencies, £2,500. The tender of the British Consolidated & Helsby Co. for the supply of 4,000 yards of cable, required immediately for extensions of existing distributors and waiting services, has been accepted.

Bradford.—MAINS EXTENSIONS.—The E.C. has authorised extensions of mains and of transformer-chamber equipment, at a total expenditure of £2,160.

Brighstone (Isle of Wight).—E.L. SCHEME.—Mr. J. W. Fisk has informed the Isle of Wight R.D.C. that he is installing an electrical plant in a mill, and he proposes to supply electricity to the village by means of an overhead line.

Bristol.—NEW PLANT.—The E.C. reports that, owing to the greatly increased demand both for single-phase current and for D.C. in the central Bristol area, it is necessary that additional plant be procured immediately, and recommends that a 2,000-KW. single-phase turbo-alternator, with auxiliaries, should be put down at Feeder Road generating station, at an estimated cost of £28,500, and that a 1,000-KW. D.C. converter, with auxiliaries, should be put down at Temple Back, at an estimated cost of £7,835.

Burnley.—EXTENSIONS.—The development of the electricity undertaking has recently been under consideration, and a report on the matter states that the Sub-Committee considers that the space available for the extension of the generating station on its present site is very limited, but all available space should be taken advantage of to the full, and extensions proceeded with at once. It is proposed to install in the existing station an additional 3,000-KW. turbo-alternator, with three water-tube boilers, economisers, cooling tower, piping, a rotary converter, and other accessories, at an estimated cost of £75,000, and to obtain borrowing powers. These extensions will increase the plant capacity to 8,000 KW., but that would not be sufficient to meet the anticipated demands of the future. It would be necessary at an early date to consider the question of an additional supply. It is recommended that an agreement be entered into with the Leeds and Liverpool Canal Co. to take water from the canal for condensing purposes at the rate of 0·01d. per unit generated. These terms the Canal Co. is prepared to agree to. The estimated cost of piping and connecting up is £1,500, provision for which is made in the total sum of £75,000. It is considered that if canal water can be used a saving in fuel will be effected.

Church Stretton.—PRICE INCREASE.—The Electricity Co. proposes to raise the price of electricity from 8d. to 1s. per unit, and an application for authority under the Temporary Increases Act is being made to the B. of T.

Continental.—FRANCE.—The coal shortage is still acute, and in order to economise supplies, public lighting in Paris is to be considerably reduced, and in some instances discontinued altogether.

Darlington.—LOAN INQUIRY.—A M. of H. inquiry was held last week into the application of the T.C. for a loan of £40,000 for extensions to the mains and services, and for £3,300 for an ash conveying plant. There was no opposition.

Dover.—MINIMUM CHARGE.—The T.C. has withdrawn the minimum charge for electricity, and is to return money paid by consumers who had discontinued their supply because of the charge.

Hampton Wick.—PROPOSED PRICE INCREASE.—The Twickenham and Teddington E.S. Co. has informed the U.D.C. that, in accordance with leave given by the B. of T. after the inquiry held last August, it is to renew the application for power to increase the maximum prices for electricity to 10d. per unit.

Hebden Bridge.—PRICE INCREASE.—As from January 1st the charge for electricity for lighting is to be increased from 6½d. to 7d. per unit, and for power from 10 to 20 per cent. on the price of 3d. per unit.

Hull.—STREET LIGHTING.—Reporting on the extension of electric street lighting, the city electrical engineer recommends the installation in certain streets of 80 360-C.P. gas-filled lamps. The inclusive annual charge for such lamps on a 4,000-hour basis, and allowing for a 50 per cent. reduction on light at midnight, would be £8 per lamp.

Liverpool.—NEW PLANT.—Application is to be made to the M. of H. for sanction to borrow £200,000 for the provision of additional generating plant, boilers, cooling towers, &c., in connection with the reconstruction of the Lister Drive power station.

London.—ILLUMINATED SIGNS.—London's electric signs, prohibited during the war for purposes of economy, are rapidly reappearing. Now that official restrictions on consumption of electricity have been removed, there are indications that there will be a boom in illuminated signs as soon as labour conditions permit.

HACKNEY.—The borough electrical engineer urgently appeals to consumers to limit their demands between 4 and 6 p.m. On November 28th the demand between these hours very nearly caused a breakdown, and if the appeal is not responded to it will become necessary to lower the pressure. Until new plant and mains are installed, lighting should not exceed 75 per cent. of the normal, and power consumers must also reduce their load. Shopkeepers are particularly requested not to use excessive display lighting, especially between 4.30 and 5.30 p.m. Outside lighting and illuminated signs must not be used before 6 p.m.

The E.C. recommends, subject to the B. of T.'s approval, that the suggestion made by the Shoreditch B.C. regarding the linking up of the two systems be approved. The Shoreditch Council is to carry out the work at its own expense. This will complete the electrically-linked ring of boroughs, viz., Hackney, Poplar, Stepney, and Shoreditch. The Council's agreement with Poplar in connection with this linking-up scheme has been revised.

GREENWICH.—At a cost of £33,000, two new mechanical coal navvies are to be installed at the electricity works. Each will be capable of unloading 100 tons of coal per hour. The present cost of handling coal is approximately 1s. 1½d. per ton, compared with 8½d. when the navvies are installed.

HAMMERSMITH.—On November 30th a short circuit occurred between the main bus-bars of the generating station switchboard, apparently due to the breaking of an insulator and consequent exposure of a live conductor. The large alternator received a severe blow which disturbed some of the connections, and some of the turbine blades were damaged. Two jointers were injured, and the station was entirely shut down for 50 minutes.

The B.C. is recommended to give the necessary authority to the Fulham B.C. to enable the latter to commence obtaining quotations for work and materials in connection with the linking-up scheme agreed upon by Battersea, Fulham, and Hammersmith.

Madagascar.—WATER POWER.—The Government *Gazette* of the French Colony of Madagascar publishes particulars of a scheme which has been approved for a hydro-electric installation at Tamatave. The waterfalls are situated 10 to 15 miles west of Tamatave, on the Ivondrono River. The capacity of these falls is estimated at 3,000 H.P. In addition to the municipality at Tamatave the Colony of Madagascar and dependencies will also become interested, and the water power will be available to furnish electricity for the general future needs of the colony in connection with the electrification of the railway from Tananarive to Tamatave, a distance of 229 miles, electrometallurgical and electrochemical industries, &c. The obligation of the municipality will be reduced to the installation of two groups of turbines to furnish 500 KW. of alternating current, power cables, transformers, and the distribution of water in the town of Tamatave. The colony's expenses in this connection will, it is estimated, be £24,125, and those of the municipality of Tamatave £47,285.

Manchester.—PROPOSED PRICE INCREASE.—At a T.C. meeting, last week, objection was taken to the proposal to add 25 per cent. to the charges to ordinary lighting consumers, making the war additions 100 per cent., and to add 25 per cent. to ordinary power consumers' charges, making the war additions 125 per cent. In the discussion, the chairman of the Electricity Committee said that the question of a reduction in price was going to be some-

what complicated, because all the coal they got was used for the general generation of all the energy. Out of the 200,000,000 units consumed per annum, 17,000,000 were for household purposes, that was equal to 8½ per cent. of the coal used, and all they could ask was that on this 8½ per cent. they should have the reduction of 10s. That would make a reduction in the price of electricity for household and domestic purposes of less than ½d. per unit. The proposed new charges were eventually agreed to.

Rawtenstall.—Loan.—It has been decided to apply for power to borrow £117,000 for extensions to the electricity undertaking, of which sum £87,000 is required for immediate purposes.

Rotherham.—Bulk Supply.—An application has been received from the Yorkshire E.P. Co. for the Corporation to supply it with electrical energy to be delivered at the northern end of the Corporation's area. The E.C. recommends that the chairman and vice-chairman of this Committee, together with Alderman Aizlewood, be authorised to interview the Yorkshire E.P. Co., and report on the question.

St. Albans.—Area Extension.—The North Metropolitan E.P. & S. Co. has intimated its intention to apply for powers to extend its area of supply from Edgware Road to St. Albans.

St. Annes.—Electric Fires.—The electrical engineer (Mr. J. H. Clothier) reports an exceptional demand for electric fires.

Torquay.—Year's Working.—The revenue account on the electricity undertaking was overdrawn on October 31st to the extent of £12,794, and the capital account, £11,065. On January 1st the debit balance at the bank was £7,766, which increased to £9,977 by September 30th, the book debts being £3,349, leaving a debit balance of £6,628. Mr. H. J. Nisbet, on behalf of the Tramway Co., repeated an offer he made three years ago to buy the concern and give the Council £30,000 profit.

Tunbridge Wells.—Loan.—The T.C. has applied for loans of £3,184 for excess expenditure, and £1,835 for a switchboard.

Ulverston.—E.L. Scheme.—The U.C. is to enter into the electricity supply scheme for the area extending from Bootle, in Cumberland, to the River Winster on the borders of Westmorland, which includes Barrow and the Ulverston Union area. Councillor Dilerville said Ulverston would welcome an electricity supply, especially for industrial and trade purposes. Councillor Dilerville was asked to meet the directors of the North Lonsdale Iron Co. with a view to ascertaining the possibilities of utilising the waste gases at the iron works for the purposes of generating electricity.

United States.—Fuel Shortage.—Notwithstanding appearances in favour of a settlement of the coal strike, which has lasted for six weeks. Dr. Garfield, Fuel Administrator, has issued drastic regulation with a view to coal economy to become effective immediately throughout the U.S.A. They apply to household coal, coke, and heat, light, and power, derived therefrom. All street lighting must be curtailed, and all stores, office buildings, and industrial plant are rationed both for lighting and heating. All factories in non-essential industries are permitted to work only three days per week, and electric railways must reduce schedules to the minimum; electric cars must not be heated during the busy hours. No ornamental or electric advertising signs, show-window or show-case lighting may be used. Certain places of amusement are only permitted to use light between 7 and 11 p.m. Restaurants must reduce lighting, office lights must be extinguished at 4 p.m., and office and store heating must not exceed 68° F. It is understood that when the strike is settled, the Fuel Administrator will resign and pass his duties to a commission to be appointed by President Wilson, and which will include a strong representation of miners.

Weston-super-Mare.—Price Increase.—The E.S. Co. has increased the price of electricity by ½d. per unit on the flat and maximum demand rates, and by ¼d. per unit for heating and power.

Weymouth.—Year's Working.—The annual report on the working of the electricity undertaking for the year ended March 31st last, shows that the gross receipts totalled £16,567; expenditure, £12,469; gross profit, £4,098, which was available towards interest on loans, &c., £1,587, and repayment of loans, £3,142, leaving a net loss on the year's working of £631. Total units sold, 1,087,347, against 958,347; public lighting, 59,461, against 59,438; private consumers, 1,027,886, against 898,909. The load-factor was 23·2, against 19·16 per cent.; maximum load was 535, against 565 kw.; number of consumers increased by 28 to 1,351; heating apparatus increased by 58 to 915, equivalent in 33-watt lamps.

Whitby.—Loan.—The U.D.C. is to apply to the M. of H. for sanction to borrow £21,000 for extensions to the electricity works.

York.—The B. of T. has extended the time of the York Electric Lighting (Extension) Order, 1914, until April 31st, 1920.

TRAMWAY AND RAILWAY NOTES.

Bradford.—Goods Service.—A letter has been received from the Ministry of Transport, asking for particulars of the railless battery goods vehicle used by the department, and inviting the general manager (Mr. R. H. Wilkinson) to interview the Minister of Transport on the subject. The general manager has been instructed to give all necessary information in the matter.

Bury.—Breakdown.—Owing to a breakdown at the Chambers Hall electricity works on December 2nd, a stoppage of tramway traffic occurred for nearly an hour.

Central London Railway.—The Minister of Transport has extended the time of the Central London Railway Act, 1913, for the construction of the railways and works authorised, until August, 1921.

Continental.—Holland.—According to *The Times* the Dutch railways intend to electrify the system between Rotterdam, The Hague, Amsterdam, and Amersfoot.

Norway.—A report from Trondhjem states that Mr. Schreiner, chief engineer in connection with the electrification of the Drammen Railway, mentioned in the course of a lecture that a scheme is now being worked out for the conversion of the Norwegian Railways to electric traction. As compared with the present prices of coal, the conversion to electrical working would represent a coal economy of 20,000,000 kroner per annum. The scheme will be brought forward shortly, and the Government has asked the Railway Administration to expedite the preliminary work.

Edinburgh.—Fares.—The T.C. has approved of a recommendation that the minimum fare be 1½d.

Glasgow.—Proposed Fare Increase.—The T.C.'s present Committee on tramways has turned down the proposal to increase the car fares, by 10 votes, and has agreed to recommend the T.C. that no change be made during the present financial year (which ends on May 31st, 1920).

Halifax.—Bill.—The T.C., last week, confirmed a decision to promote a Parliamentary Bill for borough extensions, tramways extensions, and other purposes.

Lancaster.—Last week the T.C. debated the question of the continuance or otherwise of the town's tramways. It was stated that during the 16 years' existence the tramways had resulted in a loss to the town of over £40,000, and, if they continued, about £12,000 must be spent on them immediately. Proposals were submitted to substitute motor-'buses to serve the whole town, and it was decided to engage an expert tramway engineer to report on the question to the Council.

Light Railways.—The Minister of Transport has recently confirmed the following Orders made by the Light Railway Commissioners:—

Ashover Light Railway Order, 1919, authorising the construction of a light railway in the parishes of Stretton, of Sherland and Higham, of Brackenfield, and of Ashover, in the County of Derby.

Liverpool and Prescot Light Railway (Amendment) Order, 1919, amending the Liverpool and Prescot Light Railway Order, 1898, and authorising the City of Liverpool to purchase the undertaking authorised by that Order.

Liverpool.—The Minister of Transport has confirmed the Liverpool and Prescot Light Railway (Amendment) Order, 1919, amending the Liverpool and Prescot Light Railway Order, and authorising the Corporation to purchase the undertaking.

London.—L.C.C.—The Report of the Departmental Committee on Heavy Road Vehicles has been adopted by the L.C.C., but the opinion was expressed that provision should be made for the payment of compensation to road and tramway authorities for damage caused to paving by heavy road vehicles.

Traffic Control.—The Advisory Committee on London Traffic has made its initial recommendations, which have been approved by the Minister of Transport. In the first place, with the object of facilitating the movement of traffic, extensive alterations in the stopping places of omnibuses and tramcars are to be made.

Middleton.—Proposed Fare Increase.—The Electric Traction Co. (Lancs.) is applying to the Light Railway Commissioners for an amendment of its order to enable it to increase fares. The Middleton cars run into part of Rochdale, and as the company is asking for a higher minimum fare than the Corporation is allowed to charge under its new scale, the Rochdale Tramways Committee is to object to the proposals.

Nelson.—Bulk Supply.—Representatives of Nelson and Colne Electricity Committees have met regarding an immediate supply of electricity for Colne tramways. It was decided to give a supply to Colne at 2½d. per unit if arrangements can be completed.

Breakdown.—The whole of the tramway services in Nelson, Barrowford, and Colne were stopped on December 4th for an hour in the evening. The stoppage was caused by a breakdown at the electricity works.

Rochdale.—New Cars.—The Tramways Committee has accepted a tender for the supply of 10 double-deck, top-covered cars. These will be the first covered-top cars purchased by the Corporation.

TELEGRAPH AND TELEPHONE NOTES.

Brazil.—The three principal cities of the State of Rio Grande do Sul (Porte Alegre, Pelotas, and Rio Grande) are about to renew the plant of their telephone networks. That of Porte Alegre numbers 10,000 lines, with 5,000 subscribers; Pelotas has 5,000 lines, and Rio Grande 2,000. Other towns, such as Bage, Caxais, Santa Cruz, Sao Leopoldo, and Cacholera have smaller networks, but the aggregate totals a large figure. The telephone company which is established in the Republic is now considering plans for the extension of its operations.

Cable Rates.—The Eastern Telegraph Co. announces that the charge for telegrams from Great Britain to Hong-Kong, China and Manila, will, from January 1st, be reduced from 3s. 6d. to 3s. per word.

Germany.—Telephone communication between the Rhenish Provinces and France has been re-opened. The new direct telephone service between Germany and Sweden, 625 miles, including 87 under sea, was successfully inaugurated on December 1st.

New Zealand.—During the fiscal year ended March 31st, 1918, there was expended on telegraph and telephone extension in New Zealand $570,670, as compared with $989,413, for the previous fiscal year. During the fiscal year 1918 there were 683 miles of wire strung, and 121 miles of poles set; and greater extensions were contemplated by this department for 1919. There were 12,330 miles of wire added to the telephone exchange plant in the Dominion during the fiscal year, and 13 new exchanges opened during the year, with additional accommodation added in 28 others; additional exchange connections for the year amounted to 4,940. During the year 26 new coin-in-the-slot telephones were installed, making a total of 263 telephone slot machines, with extensive plans for extension of the automatic telephone installation in this Dominion for 1919. Two cents put the lines in service for five minutes.—*T. & T. Age.*

Telephone Service.—In reply to a question in the House of Commons, Mr. Pike Pease said that a fair supply of subscribers' instruments was now coming in, but considerable arrears had to be overtaken in the manufacture and installation of plant and apparatus in exchanges, and in the construction of underground lines. Regarding the revision of current charges, he hoped shortly to be in a position to place proposals before a Select Committee.

United States.—The Senate has passed a Bill authorising President Wilson to call an "International Communication Conference" to consider cable rates and other questions proposed by the representatives of the Allies and the United States in Paris. The Conference is expected to deal with the disposal of the German cables.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared.)*

OPEN.

Australia.—SYDNEY.—January 14th, 1920. N.S.W. Railways and Tramways Department. 70 3-phase induction motors for terminal wheat elevator.*

January 19th, 1920. Sub-station equipment (except power transformers). Contract No. 558.*

MELBOURNE.—P.M.G.'s Department. January 20th, 1920. Automatic telephone switchboard at Collingwood. Schedule 1,583. (September 19th.)

Barnes.—January 20th, 1920. U.D.C. Electricity Department. Supply of water-tube boilers, economisers, draught plant, turbo-alternators, condensers, air and circulating pumps, transformers and rotary converters. (See this issue).

Belfast.—December 22nd. Electricity Department. Steam, water and other pipework for the New Harbour power station. (November 28th.)

Belgium.—December 16th. The municipal authorities of St. Gilles, Brussels, are inviting tenders for the supply of a 1,000-H.P. generating set, comprising engine and continuous-current dynamo. Tenders are to be sent to, and particulars obtained from, the Hotel Communal, St. Gilles, Brussels.

January 7th, 1920. Belgian Post and Telegraph Authorities, Salle de la Madeleine, Brussels. Miscellaneous telegraph material, including 375 tons of bronze wire, bare and insulated copper wire and cable, &c.

Bournemouth.—December 15th. Tramways Committee. 20 bogie electric tramcars. Mr. J. Bulfin, General Manager, Tramways Office, Lansdowne Crescent.

Govan (Glasgow).—December 30th. Clyde Navigation Trustees. Electrically-driven de-watering pumps for Nos. 1, 2 and 3 Graving Docks, Govan. W. Bridges & Co., Engineers, 3, Salters Hall Court, London, E.C. 4.

Halifax.—January 5th, 1920. Tramways Department. Stores and materials for period February 1st, 1920, to March 31st, 1921. Tramways Engineer, Tramways Office, Skircoat Road.

London.—STEPNEY.—B.C. The Electricity Committee is shortly to invite tenders for two water-tube boilers, with chimneys, economisers, &c., and one 5,000-KW. turbo-alternator, with condenser, accessories and switchgear.

L.C.C. The Highways Committee recommends that tenders be invited for the provision of a coal-conveying plant at Greenwich generating station.

Londonderry.—December 13th. Electricity Department. Two 500-KW. rotary converters with transformers, E.H.T. cubicles with switchgear, L.T. D.C. panels, cables, &c. (November 21st.)

Penzance.—December 17th. B. of G. Electric lighting of Poor Law Institution at Madron. Mr. T. Cornish, Clerk, 8, Parade Street.

Sheffield.—January 2nd, 1920. Electric Supply Department. Supplying and laying of six-core, E.H.T., split-conductor cable (contract No. 268). (See this issue).

Tipperary.—December 13th. B. of G. Electric generating plant, comprising: suction gas engine, suction gas-making plant, dynamo, &c. (December 5th.)

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence), London.

CLOSED.

Bolton.—Electricity Committee. Accepted:—

Four boilers, with superheaters, stokers, &c.—Babcock & Wilcox, Ltd.
Switchgear buildings, Spa Road.—W. Z. Seddon.

Bradford.—Tramways Committee:—

400 tons high silicon steel rails, £8,400.—Walter Scott, Ltd.
Six tons steel tie bars, £228.—Hadfields, Ltd.
3,500 copper rail bonds, £659.—Britannia Lamp & Accessories Co., Ltd.
15 tons wrought-iron welded rings, £705.—Bayliss, Jones & Bayliss, Ltd.
One ton clips, £85.—W. W. McKenzie.
70 tons round mild steel rods, £1,627; two tons bolts and nuts, £96.—Accordingly, Armstrong & Co.

Electricity Committee:—

Extension to suction ash-handling plant.—Babcock & Wilcox, Ltd.
Two 1,500-KW. rotary converters.—Metropolitan-Vickers Electrical Co., Ltd.
Induced-draught plant.—Musgrave & Co., Ltd.

Cape Town.—The following tenders were received for wiring the new premises of the African Homes Trust, Ltd.:—

J. A. Woods & Co.	£557
Edward A. Shaw & Co. (accepted)	**668**
W. A. Roper & Co.	649
R. G. Jack & Son	640

Dundee.—Corporation Electricity Committee. Accepted:

4½ mile three-core cable.—B.I. & Helsby Cables, Ltd., £8,190.
Steel work.—Clyde Structural Iron Co., £5,531.

Glasgow.—Cleansing Committee. Accepted:—

Electrical materials.—W. McGeoch & Co., Ltd.

Tramways Committee. Recommended:—

Trolley wire.—W. Clark & Co.
Chrome shoulders.—W. & J. Martin.

Johannesburg.—The Municipal Council has given an order for 26 tramcars to America, the prices being much under those of British cars. It has accepted the tender, submitted by Messrs. Fraser & Chalmers, at £520 each, for bogie trucks; these are of American manufacture. British quotations were £710 and £718. For electrical equipment the lowest tender was that of the S.A. General Electric Co. (American manufacture), at £1,063 per car, the lowest British tender being £1,661. In the circumstances the Council has ordered the equipment from the S.A. General Electric Company.

Leeds.—Electricity Committee. Accepted:—

British Electric Transformer Co., Ltd.—46 transformers, £19,704; further transformers as required during the two years ending December, 1921.
W. T. Henley's Telegraph Works Co., Ltd.—Eight miles of cable, £7,540.

London.—STEPNEY.—Electricity Committee has accepted the following offers of coal:—

5,000 tons Tamworth beans, 36s. 10d. per ton; Griff peas, 34s. 6d. per ton; or Ansley Hall peas (at contractor's option), 35s. 7d. per ton.—Bradbury, Son & Co., Ltd.
Two barges Northumberland rough small, 42s. per ton.—W. Cory & Son, Ltd.
200 tons scotch washed peas, 48s. per ton.—W. Hudson & Co., Ltd.
Six barges North Country N/S, 45s. per ton.—Shipping & Coal Co., Ltd.
One barge Mansfield slack, 25s. 1d. per ton; two or three wagons B. Leicester slack, 33s. 11d. per ton.—Bradbury, Son & Co., Ltd.

Sunderland.—Electricity Committee:—

L.T. box compound.—Dussek Bitumen Co., Ltd.
Cable.—Pirelli-General Cable Works, Ltd.
Sundries for service work.—B.I. & Helsby Cables Co., Ltd.
House-service meters.—Ferranti, Ltd.
Super-heater tubes.—British Mannesmann Tube Co., Ltd.

Tramways Committee:—

Six new tramcars.—English Electric Co., Ltd.

Tunbridge Wells.—T.C.—

Switchboard.—B.T.H. Co., Ltd., £1,835.
Economiser, £1,322.—Green & Sons, Ltd.*
Induced-draught plant, £255.—Keith, Blackman & Co.
1,000-KW. turbo-alternator set, £9,788, and spares, £295.—Fraser & Chalmers, Ltd.
Pipe work, £2,184.—Aiton & Co.
Surface condenser and steam ejector pumps, £3,500.—Mirrlees, Watson, Ltd.

FORTHCOMING EVENTS.

Society of Technical Engineers (Woolwich Branch).—Friday, December 12th. At the Royal Oak Hotel, Woolwich. At 7 p.m. Paper on "The Proper Position of the Engineer in Political and Industrial Circles," by Mr. E. C. de Segundo.

Friday, December 19th. At the Memorial Hall, Albert Square, Manchester. At 7.30 p.m. Address on "The Value and Purpose of Organisation," by Mr. E. M. Wrong.

Electro-Harmonic Society.—Friday, December 12th. At the Holborn Restaurant (Venetian Chamber). At 8 p.m. Smoking concert.

Junior Institution of Engineers.—Friday, December 14th. At 99, Victoria Street, S.W. At 7.30 p.m. Paper on "A Walk through the Shops at Richborough," by Mr. R. S. Kirlew.

Friday, December 19th. At 7.30 p.m. At the Royal United Service Institution, Whitehall, S.W. Lecture on "The Influence of the War on Engineering," by Sir E. H. Tennyson D'Eyncourt.

Birmingham and District Electric Club.—Saturday, December 13th. At the Grand Hotel, Birmingham. At 7 p.m. Annual general meeting.

North of England Institute of Mining and Mechanical Engineers.—Saturday, December 13th. At 2 p.m. At the Memorial Hall, Newcastle-on-Tyne. Ordinary meeting.

Faraday Society.—Monday, December 15th. At Burlington House, Piccadilly, W. At 7.30 p.m. Annual general meeting.

Illuminating Engineering Society.—Tuesday, December 16th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 8 p.m. Lecture on "The Art of Camouflage," by Capt. W. A. Howells.

Institution of Civil Engineers.—Tuesday, December 16th. At Gt. George Street, S.W. At 5.30 p.m. Paper on "Precise Levelling," by Major E. O. Henrici, R.E.

Liverpool Engineering Society.—Wednesday, December 17th. At the Royal Institution, Colquitt Street. At 8 p.m. Paper on "Science and Art of Lubrication," by Mr. H. F. Newbigin.

Royal Society of Arts.—Wednesday, December 17th. At John Street, Adelphi, W.C. At 4.30 p.m. Paper on "The Present Economic Position of Russia, and Some Aspects of its Future Development," by Mr. C. Grunewald.

Belfast Association of Engineers.—Thursday, December 18th. At the Municipal Technical Institute. At 7.45 p.m. Paper on "Wireless Communication in the War," by Major R. Stanley.

Institution of Electrical Engineers.—Thursday, December 18th. At the Institution of Civil Engineers, Gt. George Street, S.W. At 6 p.m. Paper on "Electricity in Tin Mining," by Messrs. D. M. W. Hutchison and W. J. Wayte.

Monday, December 15th. Informal meeting. At the Chartered Institute of Patent Agents, Staple Inn Buildings, W.C. At 7 p.m. Discussion on "Some Reflections on Labour," to be opened by Mr. R. Rankin.

(North-Eastern Centre.)—Monday, December 15th. At 7.15 p.m. At the Armstrong College, Newcastle. Lecture on "Electrical Developments in Christchurch, New Zealand," by Mr. J. Lythgoe.

Wireless Section.—Wednesday, December 17th. At the Institution of Civil Engineers, Gt. George Street, S.W. At 6 p.m. Paper on "High-frequency Resistance of Wires and Coils," by Prof. G. W. O. Howe.

(North-Western Centre).—Tuesday, December 16th. At the Engineers' Club, Manchester. At 7 p.m. Paper on "Scientific Works Management," by Mr. J. M. Scott-Maxwell.

(South-Midland Centre).—Wednesday, December 17th. At the University, Birmingham. At 7 p.m. Paper on "Scientific Works Management," by Mr. J. M. Scott-Maxwell.

(Irish Centre.)—Thursday, December 18th. At the Royal College of Science, Dublin. At 7 p.m. Paper on "Water Power," by Mr. T. C. Roberts.

Chemical Society.—Thursday, December 18th. At 8 p.m. At Burlington House, Piccadilly. Lecture on "War Experiences in the Manufacture of Nitric Acid and the Recovery of Nitrous Fumes," by Prof. J. Walker, F.R.S.

Institution of Mechanical Engineers.—Friday, December 19th. At Storey's Gate, S.W. Paper on "The Cutting Power of Lathe Turning Tools," by Mr. G. W. Burley.

NOTES.

New Cable Standards.—We have received the following communication on this subject, too late for inclusion in our "Correspondence" columns :—

"The heading of this correspondence indicates what I understood in the first instance, viz., that it was a discussion based on technical questions, and, as such, I desire to assist members of the industry to understand the situation.

"The question of price may be very interesting and important, but I am not prepared to mix this question up with that of cable standards, and the suggestion that has been made that the British Engineering Standards Association altered the standards of cables with the assent of the whole industry in order to assist the C.M.A. in a price manœuvre is ridiculous.

"With regard to the question of the use of '0015 sq. in. instead of 1/18 S.W.G., I stand by what I have already stated in your issue of November 28th. I have been unable to get into touch with the chairman of the Wiring Rules Committee of the I.E.E., but I have seen a copy of the letter sent to Mr. Pinto, from which it is clear that the answer of the chairman refers to the existing rules, the question of Rule 39 not having been considered by the Wiring Rules Committee. I cannot in any way pledge the I.E.E. Wiring Rules Committee, but I have no doubt in my own mind that at a meeting which will take place in a few days, an authoritative statement will be issued that in Rule 39 '0015 sq. in. wire is substituted for 1/18 S.W.G.

"THE CABLE MAKERS' ASSOCIATION,
"LLEWELYN B. ATKINSON,
"London, *December 10th*, 1919. *Secretary.*"

The Electric Vehicle Committee.—The *Electric Vehicle* states that three changes have recently occurred on this Committee, Mr. A. J. Makower taking the place of Mr. P. A. Mossay, on behalf of Ransomes, Sims & Jefferies, Ltd., Mr. H. Mozley (Burnley) succeeding Mr. A. R. Fearnley as representative of the Municipal Tramways Association, and Mr. L. E. Harvey (Ilford) taking the place of Mr. W. T. Robson as representative of the Tramways and Light Railways Association.

Electricity Supply on the Rand.—A correspondent of the *Financial Times* states that at a meeting of the local Institute of Electrical Engineers, several members criticised the policy of the Victoria Falls and Transvaal Power Co.

Mr. Clayden said that to maintain a load factor of 70 per cent., electric hoists could not be worked until the reduction plant was in operation. Hence steam-hoisting was being adopted at all the new shafts on the Far Eastern Rand. Instead of the estimated saving of 6d. to 1s. per ton crushed, it was actually proving to be only 2d.

The president of the Institute, M. Du Pasquier, observed that general electrification was being hampered by artificial restrictions. Burning coal to run separate winders and compressors was unprogressive. Even though the Victoria Falls Co. should later quote a better rate, it was inconceivable that such could be made sufficiently attractive to warrant the double captial expenditure involved in the conversion to electrical operation of the steam plants now being erected. The pursuance of the policy of inflicting a penalty against a low electric load factor would create a group of individually-owned stations in the Far East Rand.

Both M. Du Pasquier and Mr. Kirkland, who followed him, paid high tribute to the engineering skill and talents of the Victoria Falls Co.'s engineering staff.

Mr. Ottley, the company's engineer, said that the criticisms would be answered at the proper time and in the proper place. He questioned the Institute's right to discuss the matter.

Research Conference.—A Conference of representatives of research organisations connected with the Scientific and Industrial Research Department will be held at the Institution of Civil Engineers, at 2.30 to-day. Mr. Balfour will preside, and will deliver an introductory address.

Conference on Pipe Threads.—A Conference on Pipe Threads, under the ægis of the British Engineering Standards Association, is to be held at the Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W. 1, to-day, at 2.30. The Association is inviting manufacturers and users to attend this Conference in order that they may have first-hand information as to the exact situation. We are asked to state that any firms who wish either to be represented or to have further information with regard to the matter should at once communicate with the Secretary of the British Engineering Standards Association, 28, Victoria Street, London, S.W. 1. The matters to be discussed are of the highest importance to our export trade.

Wire Submarine Nets.—The Royal Commission on Awards to Inventors recently heard the claim of Mr. Albert Close, of Ilford, respecting the origination of a submarine net fitted with an electric wire. By this device it was possible to tell when the net had been broken by a submarine, as the electrical circuit would be affected at the same time. The claimant stated that this idea had been elaborated by the Admiralty, but the nets were not constructed until after his suggestion had been put forward.

Mr. Moritz, for the Treasury, said that the idea of wire nets for entangling submarines was an old one; the electric wires had never been used as indicators, but for the purpose of firing mines.

The Chairman said that the Commission would consider its award.

Inquiries.—Agents for the "Hoover" electric vacuum cleaner and makers of the vibratory rectifier patented by Edgar Gigel are asked for.

Aberdeen Ex-Service Men.—Last Friday night the staff and employés of the Aberdeen Corporation electricity works entertained some 30 of the ex-Service men of the department who had returned to the works at an "At Home and Dance," in the Bon-Accord Hotel, Market Street. Mr. Bell presided over the company, which totalled nearly 130. Songs were rendered during the evening, and after supper, the toast of "The King" was given on the call of the chairman. The assembled company stood while the names of the three men who had made the supreme sacrifice were read. These were Leading Seaman William Smith, Corpl. James B. Thomson, and Private Charles McDonald. In all, 59 men left the department; they represented approximately 50 per cent. of the average working staff during the war. The four prisoners of war—Messrs. Robert Aitken, Fred. McDonald, Frank Glass, and John C. Aiken—were released at the Armistice, and were present. Mr. Bell congratulated Major Webster on winning the Military Cross; Corpl. G. Troup and A.-M. R. Ross on gaining the Military Medal; and Sergt. W. Ogg on having received the M.S.M. In calling on the Convener to address the meeting, Mr. Bell pointed out that of the 210 hospital trains which arrived at Aberdeen, Mr. Gibb had met 205, at all hours of the night and day. This represented some 30,000 patients. Mrs. Gibb also had worked very hard for the Red Cross. Mr. Gibb briefly addressed the meeting, and was followed by Mr. Fyfe on behalf of the rank and file. Lieut. W. Hodson replied for the guests, and Mr. Bell was thanked for presiding.

Film Photography.—Five hundred exposures a second is the record in film photography made by two French scientists, MM. Abrahams and Bloch. They used electric sparks emitted by a special apparatus, and were able to take a detailed and accurate kinematograph record of the track of a revolver bullet. The cone of gas leaving the barrel before the bullet itself was clearly visible, and the track of the bullet could be followed. Prof. Nalpasse forecasts that this invention will enable accurate photographs to be taken of every form of movement in the human organism.

An Edinburgh Dance.—The electrical trade of Edinburgh and its friends are having a dance on the evening of Monday, December 22nd, at the Kintore Rooms, Queen Street. Herbert More's orchestra has been engaged, and a good programme of music and song arranged for. Some tickets are still available from Mr. J. G. Mackintosh, 1, St. David Street, or Mr. D. S. Munro, 11, Randolph Place, Edinburgh.

Institute of Transport.—The preliminary arrangements in connection with the formation of the Institute of Transport are well advanced, and it is hoped to have ready shortly application forms for membership, so as to commence active work early in the New Year. Sir Eric Geddes, Minister of Transport, is to be the first president of the Institute, and, pending the appointment of a permanent secretary, Mr. H. E. Blain is acting as hon. sec. to the Council.

The E.T.U. in Glasgow.—Writing in the Glasgow *Evening Times*, a correspondent, signing himself "Greenlaw," says:—"I advertised for an electrician to take charge of plant, &c., and before making my complaint about the answers received, I should like to state that I wanted a Union man if possible, and as I was offering about 4d. per hour over the Electrical Trades Union standard, I expected to get a good man. I got 22 letters in answer to my advertisement. I interviewed the whole of the applicants, and was very much disappointed to find that, although all were members of the E.T.U., not one of them could tell me where he served his apprenticeship. Two were honest enough to tell me that they had only the experience of wiring they had picked up. The other 20 told me various tales of employers being dead, and places where their time was served closed up—in fact, a lot of lies, &c. But as I was very much in need of an electrician, I took on, as I thought, the best of the bunch, and was prepared to overlook any little faults that I had to find with him as regards his application. But to-day I am sorry to say that my trustfulness has been misplaced, and I have now about £500 of damaged plant through his carelessness and want of skill. I have given him a week's notice, and I am going to advertise again, but I would meantime like to know what the Electrical Trade Union has got to say about its members being unable to answer the requirements. You will know that in our business we have laid down thousands of pounds' worth of plant, and it is a skilled man that is required, and he must be able to give all details as to his experience and apprenticeship before we will start another."

Mr. James D. Higgins, the district secretary, in a letter to the *Evening Times*, challenges the writer of the letter to disclose his identity, and says:—"Meantime, through the various branches of the Union, I will get in touch with the 22 men who replied to his advertisement (if they exist). If these 22 are incompetent men, then they have obtained admission to the Electrical Trades Union in the same way the alleged destroyer of plant obtained employment with him—that is, under false pretences, and the Union will suitably deal with them." Another writer, signing himself "W. H. M.," joins in the controversy with this remark:—"The fact of a man having served an apprenticeship is no guarantee that he has either knowledge or aptitude for the trade he follows." After detailing the rules governing the admission of the members of the Union, the writer submits that "this is as much as can reasonably be expected, and it is scarcely fair to blame the Union if a man chances to slip in who is incompetent. Besides, we have various branches in the trade, which is ever extending, and a man may be an expert in two or three, and not have much experience of a fourth."

Railway Electrification in South Africa.—The Report on South African Railways, as published in the technical papers last month, offers an interesting comparison with American practice. From the recent article on "Mineral and Goods Traffic Electrically Operated," in our August issues, we quote only the comparative distances between sub-stations for the particular traffic, grades, and curves on those American railways. These details and the gauge are all different in the case of South African railways, and different results accentuate the necessity for expert study of each case:—

Distances between Sub-stations.

	Average.	Minimum.
1915 N. & W.R. as it is—		
11,000 v., one-phase	7 miles	5 miles.
N. & W.R., redesigned with—		
3,000 v., D.C., and C.M. & S.P.R. losses	13 „	11 „
1915 C.M. & S.P.R. as it is—		
3,000 v., D.C.	32 „	23 „
C.M. & S.P.R. redesigned with—		
11,000 v., one-phase, and N. & W.R. losses	14 „	10 „

(Electrical Review, August 29th, 1919, page 281.)

For comparison:—

1919 South African railways—	
3,000 v., D.C., proposed	25 to 30 miles.
Alternative system—	
10,000 to 15,000 v., one-phase ...	40 to 50 „

The sole disadvantage of the direct-current system, as compared with the single-phase system, is that more sub-stations are needed (with direct current) for South African railway traffic, grades, and curves.

Chlorine Cells.—In *Chemical and Metallurgical Engineering* for October 1st, 1919, Mr. F. G. Wheeler gives useful information regarding the construction and operation of electrolytic cells for the manufacture of caustic soda and chlorine.

The Batti-Wallahs.—At the next monthly luncheon of the Batti-Wallahs' Society, which is to be held at the Holborn Restaurant on Monday, December 15th, at 1 o'clock, Sir Lynden Macassey will be the guest and will deliver an address. Guests are invited; the charge for the luncheon is 5s. per head, and tickets will be on sale in the refreshment room.

Educational.—Manchester College of Technology.—The fact that the provision for University education in England is only one-half of the provision in America, and only one-third of what it was in Germany before the war, is mentioned in an appeal for £150,000 which has recently been made by the College of Technology. The English Universities are full, and urgently need extending. Moreover, the American superiority is increasing, for Harvard University has collected $12,000,000 during the last three months, and during one month of the same period the neighbouring Massachusetts Institute of Technology has collected $10,000,000 for the extension of its work, so that altogether some 4½ million pounds sterling have been subscribed for the extension of University education in Massachusetts, and of this nearly one-half is devoted to applied science and technology.

With a view to the extension of the provision of University education in the Manchester district, two appeals are being placed before the public, the one for £150,000 for an addition to the buildings of the College of Technology, and the other for £500,000 for various purposes connected with the other departments of the University of Manchester. The need can be economically met by the proposed extension of the College of Technology; for in the first place the proposed new building, although only one-third the size of the present building, will practically double the accommodation for undergraduates, and more than double the facilities for research. Moreover, the new building, which will cost £150,000, will stand on a site for which £44,000 was paid some 12 years ago, and will be equipped by the Governing Body at a cost approximately of £50,000, so that the building, with its equipment and its site, will be worth nearly £250,000. The cost of maintenance is also guaranteed. The result is that Lancashire industries by subscribing £150,000 for the new building will actually benefit to the extent of £250,000 (or, if the cost of maintenance capitalised as an endowment be added, to an extent of something like three-quarters of a million). The appeal has been commended, and the need for the extension has already been urged, by several of the leaders of the textile, engineering, and chemical industries in Lancashire. The Executive Committee of the Manchester Branch of the Federation of British Industries unanimously supports the movement. Subscriptions, which should be made payable to the College, may be addressed to the Principal, College of Technology, Manchester.

The demand for college-trained men far exceeds the supply, and all our Universities and Technical Colleges are at present overcrowded with students. Manchester is the centre of the chief industrial district of England, and the College of Technology has always been conducted on the most progressive lines, while the City Corporation has contributed generously both to the capital outlay and the maintenance of the College. We earnestly commend to the notice of our readers the appeal which is now being made.

The Board of Education has issued the time-table of examinations for Royal Scholarships and Free Studentships, and Whitworth Scholarships and Exhibitions, to be held in May, 1920.

Fatality.—*The Times* states that Private Clark, of the Labour Centre, Park Royal, was found dead, on Saturday, holding an electric wire which had been blown down.

Appointments Vacant.—Shift engineer jointer, for the Aldershot Electricity Works; assistant lecturer and demonstrator (£225 to £315), for the Civil and Mechanical Engineering Department of the Northampton Polytechnic Institute; three charge engineers (300 taels per month), (the usual rate of exchange for a tael is about 3s., the present rate of 7s. 4d. is abnormal), for the Shanghai Municipal Power Station; senior lecturer on mechanical engineering (£600), for the Manchester College of Technology.

Electro-Harmonic Society.—A smoking concert will be held at the Holborn Restaurant, in the Venetian Chamber, to-night (Friday), commencing at 8 p.m. Mr. H. E. Blain will preside. Artistes:—Mr. Joseph Cheetham, tenor; Mr. Lawrence Folker, baritone; Mr. Lloyd Shakespeare (cornet), Mr. C. Rutherford (concertina), duettists; Mr. Ernest Sewell, conjuror; Mr. Hector Gordon, comedian; Mr. Morland Hay, entertainer at the piano; Mr. Bernard Flanders, A.R.A.M., pianoforte solo and accompanist.

Electrolytic Disinfecting Fluid.—During the year 1918, according to the report of Dr. F. W. Alexander, Medical Officer of Heath for the Borough of Stepney, 30,750 gallons of electrolytic disinfectant were manufactured, making 61,500 gallons as diluted for distribution. The cost was for materials £114, electrical energy £51, total £165. Since the installation of the plant, a period of 13 years, 504,219 gallons of fluid have been manufactured at a cost for electricity of £586, and materials of £645; previous to the war the cost was under ½d. per gallon, and even with the strong fluid which at present is being made, and is diluted, the cost is still about ½d. per gallon.

The Kinema in School.—So successful has the kinema as an educational adjunct proved at its Belmont School, that the Chiswick Educational Committee intends to make moving pictures a regular feature in all its elementary schools.

Institution and Lecture Notes.—Institution of Electrical Engineers.—At the meeting of the members of the NORTH-WESTERN CENTRE, on December 2nd, the chairman, Mr. J. A. Robertson, announced that a sub-centre had been formed for Liverpool and District, with Dr. Marchant as chairman and Mr. Dickinson as vice-chairman. The opening meeting would take place on Monday, January 19th, when Dr. Marchant would deliver his address. A sub-centre had also been formed at Preston, and a meeting would take place on January 5th, when Colonel O'Brien would give an address on "Electric Traction."

The evening was devoted to a discussion on "The Present Position of Electric Power Supply," which was opened by Mr. Pearce; Messrs. Watson, Wheelwright, Frith, Lamb, Allcock, Aldermen Walker, Paxton, and J. D. Paton took part in the discussion.

The provisional programme of the WESTERN CENTRE for the session 1919-20 includes the following items:—

February 2nd, Cardiff.—Visit of the president, Mr. Roger T. Smith, and the secretary, Mr. P. F. Rowell; address from Dr. S. Z. de Ferranti.

March 1st, Bristol.—Lecture on "Electric Clocks" by Prof. David Robertson.

April 5th, Cardiff.—Popular lecture by Prof. F. Bacon on "Thermionic Valves."

May 3rd, Swansea.—Paper.

September 6th, Bristol.—Paper.

Faraday Society.—The Faraday Society, the Royal Microscopical Society, the Optical Society, and the Photomicrographic Society, in co-operation with the Optical Committee of the British Science Guild, meeting in joint session, will hold a symposium and general discussion on "The Microscope: its Design, Construction, and Applications," on Wednesday, January 14th, 1920.

During the afternoon preceding the meeting an exhibition will be held illustrating recent developments in the science of microscopy and the latest applications of the microscope in all branches of industry. The purposes of the discussion are to stimulate the study of, and research in, microscopical science in the United Kingdom by indicating lines of progress in the mechanical and optical design of the instrument, showing, by means of exhibits, recent improvements in the microscope and its technique, and the varied uses to which the microscope can be applied as an instrument of research in the sciences, arts, and industries; and to encourage the manufacture in this country of the highest class of instrument and of the optical glass required for that purpose.

The meeting will be presided over by Sir Robert Hadfield, F.R.S., president of the Faraday Society, who will deliver an opening address, and Mr. J. E. Barnard, president of the Royal Microscopical Society, will then give a general survey of the subject, and he will be followed by Sir Herbert Jackson, K.B.E., F.R.S. Prof. F. C. Cheshire, C.B.E., will speak on "The Mechanical Design of Microscopes," and a paper by Prof. A. E. Conrady on "Microscopical Optics" will be presented.

Further particulars relating to the discussion may be obtained from Mr. F. S. Spiers, Secretary, the Faraday Society, 10, Essex Street, London, W.C. 2, or Mr. C. J. Lock, Secretary, the Royal Microscopical Society, 20, Hanover Square, London, W. 1.

Paisley Association of Electrical Engineers.—The following office bearers have been elected for the ensuing session of the Association:—

Mr. W. Blair Smith, president; Messrs. W. Robert Scott and W. R. Bruce, vice-presidents; Mr. E. D. Anderson, B.L., hon. secretary; Mr. J. M. Barbour, hon. treasurer; Messrs. D. E. Craven, Alexander McCrorie, R. N. McNaughtan, Joseph Savage, and B. Thomson.

The syllabus for the 1919-20 session, includes:—

December 17th, 1919.—"Notes on a Modern Tramway System," by Mr. W. R. Bruce, Paisley District Tramways.

January 16th, 1920.—"Electricity and Matter," by Mr. Angus McLean, B.Sc., Principal, Paisley Technical College. (To be held in the Technical College.)

February 4th, 1920.—"Oil," by Mr. W. Murray, A. F. Craig & Co., Ltd.

February 25th, 1920.—"Historical Development of the Design of Electric Generators" (with lantern slides), by Mr. Alex. McCrorie, Fullerton, Hodgart & Barclay, Ltd.

March 17th, 1920.—Open meeting for discussion.

The second meeting of this Association was held on November 26th; a paper was read on "Works System" by Mr. R. W. Dodson, who defined system as the organisation of an establishment so as to secure the largest output at the smallest cost per unit. He emphasised the fact that individual prosperity depended on production, and stated that the largest production per man and the highest wages per man were obtained where the greatest amount of machinery was installed. He described and illustrated a system of stocktaking and stock-keeping which reduces the work to a minimum, and the card system for almost any purpose was fully dealt with in the paper.

National Association of Supervising Electricians.—A paper, entitled "Country-House Lighting," was read before a well-attended meeting at St. Bride's Institute, on the 9th inst., by Mr. R. G. Tyler, M.I.E.E. The discussion which followed was keen and sustained. Members have been warned that an extraordinary general meeting will be called during the next few days, and important matters will be dealt with.

Parliamentary.—The Shropshire, Worcestershire, and Staffordshire Electric Power Bill was read a second time in the House of Commons on December 3rd.

Royal Institution of Great Britain.—The following are included in the lecture arrangements before Easter:—

Fridays, at 9 p.m.—

January 16th.—"Low Temperature Studies," by Prof. Sir J. Dewar, F.R.S.

January 23rd.—"Researches at High Pressures and Temperatures," by Sir Chas. Parsons, F.R.S.

January 30th.—"The Gyrostatic Compass," by Mr. S. G. Brown, F.R.S.

February 27th.—"Problems of Lubrication," by Mr. W. B. Hardy, F.R.S.

March 12th.—"The Thermionic Valve in Wireless Telegraphy and Telephony," by Prof. J. A. Fleming, F.R.S.

March 26th.—"The Scientific Work of the late Lord Rayleigh," by Prof. Sir J. J. Thomson, P.R.S.

Afternoons.—

January 13th and 20th.—"Modern Development of the Miners' Safety Lamp" and "Petroleum and the War," by Sir John Cadman.

February 17th and 24th.—"Magnetic Susceptibility," by Prof. Ernest Wilson.

January 31st, February 7th and 14th.—"The Astronomical Evidence Bearing on Einstein's Theory of Gravitation," by Sir Frank W. Dyson, F.R.S.

February 21st and 28th, March 6th, 13th, 20th and 27th.—"Positive Rays," by Sir J. J. Thomson, P.R.S.

Control by Light and Sound Waves.—Interesting applications of resonance made by Captain R. A. Roberts, a New Zealand inventor, to telephony and telegraphy were referred to in our issues of June 30th and August 11th, 1916. These were based on the self-exciting vibrations of a receiver and transmitter electrically coupled together and to a battery; and the employment of a tube and plunger to provide resonance and enable tuning to be effected. Captain Roberts further developed his inventions, and applied them to the evolution of a new kind of multiple telegraphy on a single wire. Two important objects were attained: very weak incoming currents were enabled to produce strong audible signals; and the accurately-tuned instruments enabled a large number of apparatus to be operated over a single line, each transmitter actuating only the receiver tuned to the same pitch, without having any effect on those not so tuned. The great value of these two properties needs no emphasis.

The device is applicable to the control of moving trains or other moving objects, such as a motor-car, for instance. Each apparatus can be brought into action in turn by a musical note or whistle of a definite pitch. Each motor would have a resonator tuned to a definite pitch, so that any, or all, of the motions could be controlled separately or together. Captain Roberts has still further developed his inventions, and he is now able to control mechanisms by the aid of light rays as well. Recently the inventor made a demonstration, at which we were privileged to be present, which was of interest in so far as it indicated the possibilities of the future. The demonstrator, by means of a whistle, showed the effect of sound waves on a needle flame, which was made to "dance" in response to the notes of the whistle. Then a musical-box was set in motion, and stopped at will by simply focusing a ray of light on to the receiving lens; and, lastly, Captain Roberts made a small motor-car perform evolutions in response to blasts on a whistle. A certain amount of secrecy may, if desired, be obtained by employing a whistle of such a high pitch as to be practically inaudible to the human ear. During the war the Admiralty made use of very sensitive relays of Captain Roberts's invention in connection with the explosion of mines and the destruction of enemy submarine boats. We understand that a company has been formed to exploit the inventor's patents.

Luminous Buttons.—An ingenious device has just been introduced by Messrs. Falk, Stadelmann in the form of a thumb tack surface treated with a radium compound which emits a luminous glow in the dark. Attached to articles, or placed in particular positions, it enables those articles and positions to be immediately located in the dark. Such articles are electric light switches, gas taps, bell pushes, telephones, medicine bottles, match boxes, door handles, &c.

Electric Vehicle Progress.—The M. of H. has sanctioned the borrowing of £32,000 by Birmingham Corporation for the purchase of electric vehicles from Edison Accumulators, Ltd., through Mr. J. P. Kemp. The engineer is to report to Bolton T.C. concerning the purchase of a vehicle for the electricity department. Quotations for an electric vehicle to deal with cartage work are to be obtained by the East Ham borough engineer. Four vehicles for refuse collection are to be purchased by the Finchley T.C. At an estimated cost of £2,350, Harwich T.C. proposes obtaining two Garrett 2½-ton vehicles for the sanitary services whereby an estimated annual saving of £170 will be effected. Ilkley U.C. is applying for sanction to borrow £1,250 to purchase an electric tipping wagon for refuse collection. Charging plant for electric vehicles is to be provided by the Mansfield T.C. The South Shields borough engineer is to report to the T.C. concerning the use of electric vehicles. The M. of H. has granted Willesden U.C. permission to borrow £13,470 for the purchase of electric vehicles for refuse collection, and £1,470 for the provision of charging plant; the first three of the eleven "Orwell" vehicles have already been delivered. The Hackney B.C. has accepted the tender of Messrs. Ransomes, Sims & Jefferies, Ltd., for two 2-ton and two 3½-ton electric vehicles with side-tipping bodies at a total cost of £5,118. It is proposed to install a 5-unit charging plant, and an estimated saving of 1s. 10d. per ton in refuse collection will be effected by the use of electrics; other tenders received were as follows:—Garrett, £4,670; G.V.C., £4,860; Electromobile, £5,440; and Edison, £5,828.—*Electric Vehicle.*

Piezo-Electricity. — The piezo electrical effect is an electro-elastic property of certain crystals that involves the conversion of mechanical into electrical energy, and also the converse effect. An interesting paper by Mr. A. Mcl. Nicolson in the November number of the A.I.E.E. *Journal* presents an exposition of piezo-electricity and related optical and other properties belonging to these crystals. Special reference is made to the comparatively large piezo-electrical effects produced by Rochelle salt crystals prepared so as to develop the natural *composite* structure usually associated with substances which have been exposed to shearing stresses, in this case during growth. The paper concludes by describing and demonstrating the application of the piezo-electrical effect in such crystals to the transmission and reception of sound.

Labour-saving Appliances.—In the annual report for 1918 of H.M. Chief Inspector of Workshops and Factories, it is stated that since 1914 a great increase in the use of various labour and fatigue-saving devices has been noted in all classes of factories, and the increase would have been greater still but for the difficulty experienced in obtaining the necessary plant. The subject is intimately associated with that of "movement study." Simple appliances for holding the workers' tools and parts of machines are essential for the successful application of movement-study methods, and stress is laid upon the importance of the initial training of workers so that they can carry out their work with such movements as involve a minimum amount of fatigue to themselves. The first step taken in connection with labour-saving should certainly be made in the planning and arrangement of the factory itself, and many modern engineering works afford excellent examples of sound planning to minimise the amount of handling of both raw and finished materials. The importance of such apparently trivial matters as the shape and size of tool handles, as bearing on fatigue of the workers and their efficiency, has been especially brought to notice. One very noticeable development which has taken place during the war has been the improvement in hand trucks and similar appliances for the transport of materials and articles within factories. Mr. Williams (Southern Division) remarks upon the introduction of electrically-propelled railless vehicles in factories. These have been found of considerable service especially in factories covering much ground. They are run on the ordinary factory roads, and through the alleyways in the various shops, so that they can be loaded or unloaded at or close to any machine. A considerable increase in the use of electrically-propelled factory vehicles is anticipated in the future. A number of inspectors comment on the greatly increased use of overhead runways in all classes of factories, and especially in engineering works they have been introduced widely. The increased use of electric cranes of all kinds has been noted by inspectors in various industries, the hammer-head type in shipyards in place of the derrick type, and other types in iron and steel mills, as well as many additional installations of electric magnet cranes. Scrap iron and steel is very troublesome to handle in the ordinary way. The electric charging machine is another appliance which has eliminated much trying work in connection with steel furnaces. These machines have now been introduced into nearly every steel works in South Wales, and most of the steel works throughout the country. Finally, amongst the miscellaneous devices and arrangements which have been adopted to minimise labour may be mentioned automatic weighing and bag-filling machines, also automatic weighing machines introduced into the conveyor tracks.

A Standard System of Limit Gauging.—It is now widely known that the British Engineering Standards Association has had under consideration for some time past the question of a standard system of limit gauging for plain cylindrical work applicable to engineering generally. The Sub-committee on Limit Gauges, recently reorganised as a result of a trade conference held in April last, has decided to recommend the adoption of the hole basis, but has not been able to settle the important question of the disposition of the tolerances with regard to the nominal dimension. Two methods have been proposed:—

1. That the mean dimension of the hole should be its nominal size, the tolerance being both positive and negative.
2. That the minimum dimension of the hole should be the nominal size, the whole tolerance being positive.

From inquiries which have been addressed to a number of engineering firms throughout the country it appears that opinion is divided as to which method should be adopted. The difficulties besetting the subject appear to increase rather than to diminish. The questionnaire sent out to a number of firms asking which method of hole tolerance distribution they preferred brought in only some 200 replies, these being almost equally divided in favour of the two methods. The problem is rendered still more complex in that among the advocates of each system are large firms of importance and influence. The information in the possession of the committee hardly seems sufficient to enable it to judge what would be the economic results or degree of industrial disturbance, should one or the other method be recommended. Some important firms, whilst agreeing that theoretically the minimum hole basis may be ideally the best, are prevented from supporting it owing to commercial considerations. The committee is unanimous in feeling that no decision can be made until further light has been thrown on the subject.

Cost Accountants' Meeting.—The inaugural meeting of the Institute of Cost and Works Accountants is to be held at 7 p.m. on Wednesday next at the Hall of the Institute of Chartered Patent Agents. Sir Robert Hadfield will preside.

An Electrical Game.—In spite of the immense scope offered the inventor by the resources of electricity, very few electrical games have been produced. Messrs. Rose Bros., of 25. Milton Street, E.C., however, have introduced one in time for the "festive season." It consists of a board studded with brass contacts in groups of four and having a lamp in the centre. Metal disks are provided, which are thrown upon the board by the players, and the contacts are so connected beneath the board that when any two in a group of four are connected by a disk, the lamp lights up. The device is neatly got up, and is certainly novel. It is covered by a patent.

REVIEWS.

La Télégraphie sans Fil. By G. E. Petit and Leon Boutillon. Paris: Librairie Delagrave. Pp. vii×304; 197 illustrations.

It is always of the greatest interest to study works published in other countries than our own, and this is especially the case in wireless telegraphy. Much of our outside information comes from the United States, and consequently we are somewhat inclined to underrate the wireless researches and developments of such countries as France, simply because we hear little of them. The policy of silence is not to be recommended; often the wrong country or the wrong individual gets the credit. Many important inventions quietly developed in Great Britain have been transported and announced to the world in other countries. The cry that "we did it first" comes too late to be effective.

The book under consideration is divided into ten chapters. The first deals with fundamental phenomena, and a mathematical treatment of energy radiation is given. The second chapter deals with the propagation of electromagnetic waves on the surface of the earth, and explains the effect of distance, fog, conductivity of the air, seasons, time of day, obstacles, &c., on the range of a wireless station. An interesting table of the resistivities and specific inductive capacities of a variety of kinds of earth and water is given. The third chapter brings us to the different kinds of aerial normally used. The fourth is an important chapter, and describes modern methods of transmission. The use of high-tension direct current for spark transmission is given perhaps more than usual attention; the use of the arc is described in a general manner, which is rather disappointing, and likewise the high-frequency alternator is only very briefly described. The three-electrode vacuum tube is discussed in its capacity as an oscillation generator. The theory of the vacuum tube is briefly given. In the characteristic curve shown, the authors consider the positive terminal of the filament battery as having zero potential, the negative side having a negative potential equal to the voltage across the filament. It is more convenient, however, to consider the negative as having zero potential, and this convention is now universally adopted.

Chapter V deals with receiving arrangements, but is below the standard of the remainder of the book, and does not represent modern methods.

Chapter VI describes the Marconi and the Bellini-Tosi directive wireless systems, including the electrostatic radiogoniometer.

Chapter VII is an excellent account of modern high-power wireless transmitting installations. Chapter VIII is a very short, out-of-date account of wireless telephony, and the remaining chapters cover two pages.

In an appendix is given a most interesting description of a universal static transformer designed by the Compagnie Générale Radiotélégraphique.

The remaining third of the book is a reprint of regulations relating to wireless communication. The value of the volume lies chiefly in the description of transmitting stations, and in individual sections of the greatest interest. These make the book one of considerable value to the wireless engineer, as much material is given which is not found in other books on the subject.

J. Scott-Taggart.

Electrical Mining Machinery. By Sydney F. Walker, M.I.E.E. Pp. xii + 375, 132 figs. London: Sir Isaac Pitman & Sons. Price 12s. 6d. net.

On the whole this work is rather disappointing, inasmuch as the author has attempted too much within the pages of one small volume. It is divided into 46 chapters, and deals with everything relating to the electrical engineering of collieries from the generation of power including the steam turbine, down to telephones and electric shot firing. Hence the scope is too vast to do justice to any particular subject, which is a general complaint against works relating to mining electrical engineering. We must, however, give credit to Mr. Walker for making the utmost use of the space

at his disposal, and for the selection of his material, as what is given is certainly both useful and instructive, and if we might make a suggestion, it would be to add to the end of each chapter a short list of books and papers dealing more fully with each subject to which the reader can refer for fuller information. This would be particularly useful to the mining engineering reader in search of information. Another fault is that in many cases the description in the text of the illustrations is rather scanty, and reference letters given in the illustrations are not mentioned in the text. To the technical reader this may not cause much difficulty, but we are not so sure that the layman would always arrive at the correct interpretation. As already mentioned, the book deals with everything electrical in mines, and generally speaking, concisely and accurately, but in dealing with electrical winding the author makes one unfortunate slip in referring to the "load" to be raised. This is given as "the weight of the cage, plus the weight of the coal and tub on it, plus the weight of the rope." The weight to be raised is, of course, the net weight of the coal only, plus the weight of the rope where no balance rope is in use, as the cages and tubs are balanced. It is true that the weight of the cages and tubs has to be taken into consideration, but only in so far as their weight affects the "mass in motion." In dealing with fixing cables in the shaft, the author speaks of lowering the cable down the shaft from a reel on the surface. This is the commonly accepted method, but it is much easier to take the reel down the pit, and haul it up, by means of a "jack" or "crab" rope and engine. Again, it is scarcely correct to say in speaking of ram pumps, that air vessels are provided "to trap the air at each stroke," as their chief purpose is to cushion the column of water at the closing of the delivery valve.

The book is well printed, contains few typographical errors, and is well illustrated; and, with the above-mentioned reservations, is one of the best works we have seen dealing with this very important subject. No doubt it will prove useful to those requiring a general knowledge on electric mining machinery.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—Mr. H. E. BLACKISTON, A.M.I.E.E., on leaving the South Wales Electric Power Distribution Co., received an antique brass standard lamp as a presentation from the officials and staff of the company, and also a case of pipes and a tobacco pouch, suitably inscribed, from "the men of his own districts." The latter also presented Mrs. Blackiston with a silver-mounted, cut-glass scent spray. Mr. Blackiston has now taken up the duties of sub-station superintendent in the tramway department of the L.C.C.

On the occasion of his leaving the Aberdeen Corporation Electricity Department, to take up duty as assistant mains superintendent with the Dundee Corporation, Mr. GEORGE TROUP, on November 28th, was made the recipient of a watch and chain and pendant, a slide rule, and a copy of Dick & Fernie's "Electric Mains and Distributing Systems." Mr. McKay, in the unavoidable absence of Mr. Bell, made the presentation.

Mr. F. PEAKE SEATON, A.R.C.S., A.M.I.E.E., who has during the war been assisting Mr. S. G. Brown, F.R.S., in the development of his gyro-compass, has resigned his position to resume his consulting practice, and will devote special attention to gyroscopic compasses and their installation. Until a London office is open his address is 16, Market Place, Kingston-on-Thames.

Nelson (Lancs.) T.C. has increased the salary of the Electrical Engineer and Tramways Manager from £425 to £480 a year.

The staff of the Wrexham Electricity Works have presented a clock to Mr. A. H. ELLIS on his marriage.

Bolton Corporation has decided to increase the salary of the electrical engineer, Mr. W. J. H. WOOD, from £800 to £900 a year; that of the tramways manager, Mr. J. BARNARD, from £700 to £800; and that of the chief traffic assistant (tramways), Mr. C. ORMROD, from £200 to £250.

A proposal to increase the salary of Mr. P. P. WHEELWRIGHT, electrical engineer at Blackburn, has been adjourned. Mr. Wheelwright's present stipend is £800, compared with £900 paid to the new gas engineer, and £1,000 to the borough engineer.

Mr. B. HALL has been appointed manager of the Wigan Corporation tramways at a salary of £450, rising by £25 annually to £600.

Mr. F. H. RUDD, Corporation electrical engineer at Rochdale, who has had an arduous time during the last twelve or eighteen months, has had a breakdown in health, and has been granted a month's leave of absence.

Lieut. H. S. PURSEY, R.E., having been released from service, has joined the staff of the Cornwall Electric Power Co.

General.—Stepney B.C. Electricity Committee has appointed Councillor WILLIAMS chairman and Councillor AYLWARD vice-chairman for the ensuing year.

Mr. W. HOPE WILSON, M.I.Mech.E., for many years general manager of the H.S. engine and turbine department of Messrs. James Howden & Co., Ltd. (and who formerly held a responsible position with Messrs. Willans & Robinson, Ltd.), has commenced business as a consulting engineer at 29, St. Vincent Place, Glasgow. In addition to consulting work generally, he will specialise in steam turbines, engines, boilers, and electrical power plant.

The *Times* states that Lord MESTON, K.C.S.I., who recently resigned the position of Financial Member of the Council of the Viceroy of India, has joined the board of the English Electric Co., Ltd.

Prof. E. R. DEWSNUP, who since 1907 has been Professor of Railway Administration and secretary of the Faculty of the School of Railway Engineering at the University of Illinois, has been appointed to the Chair of Commerce at the University of Liverpool. Prof. Dewsnup, prior to his Illinois appointment, was lecturer in Railway Transportation at the University of Chicago, and had previously held a lectureship at Manchester University.

Mr. WILLIAM OLIVER, B.Sc., A.M.I.C.E., has recently been appointed lecturer in the Organisation of Industry and Commerce by the Edinburgh University Court. Mr. Oliver, who was educated at George Watson's College, and at the Edinburgh University, in which institution he graduated in Science with distinction, has been in the employment of Messrs. Bruce Peebles & Co., Ltd., Edinburgh, since he left school, and he now holds the position of contract engineer to that company, which position he will still hold in addition to the new lectureship. As he has had experience in all the chief departments of Messrs. Bruce Peebles' works and offices, and for some time past has been intimately connected with the commercial side of the business, first as chief of the sales department and now as chief of the contract department, Mr. Oliver's experience will stand him in good stead in connection with the new lectureship. There were over 50 applicants for the lectureship.

Obituary.—MR. JOHN ARDRON.—The *Morning Post* records the death, which occurred on December 4th at his residence at Stanmore, Middlesex, of Mr. John Ardron, C.B., M.I.E.E., late Assistant Secretary at the General Post Office. He had been identified with the telegraph service of the country since it was taken over from the private electric telegraph companies in 1870. Mr. Ardron served in 1903 as vice-chairman of the International Telegraph Conference of London. He was in his 76th year.

MR. E. F. HERD.—The death has occurred of Mr. Edward Fred Herd, electrical engineer, of Dover Road, Folkestone. Deceased, who was 33 years of age, was found killed on the railway on December 2nd. He had served during the war in the R.N.V.R.

NEW COMPANIES REGISTERED.

Riddle & Goddard, Ltd. (160,855).—Private company. Registered November 21st. Capital, £1,000 in £1 shares. Objects: To carry on the business of electrical, mechanical, motor, marine, and general engineers, &c. The subscribers (each with one share) are: W. C. Riddle, 13, Dalmeny Road, Tufnell Park, N.7, electrician; A. W. Goddard, 23, Putney Road, Balham, S.W.12, electrician. The first directors are: W. C. Riddle and A. W. Goddard (managing directors). Secretary: J. T. Cleverley. Registered office: 246, Archway Road, Highgate, N.6.

Best's "Gauzeless" Lamp Co., Ltd. (160,592).—Registered November 14th. Capital, £21,500 in 20,000 preference shares of £1 each and 30,000 deferred shares of 1s. each. To carry on the business of manufacturers of and dealers in miners' and other lamps, &c., and to acquire certain patent rights and other property for £1,000 in deferred shares, and to enter into an agreement with W. Best. The subscribers (each subscribing for one preference share) are: A. H. Marker, 11, Heath Drive, Hampstead, retired merchant; C. T. Hilder, Ashbrook, Sevenoaks, stockbroker; W. Best, 43, New Park Street, Morley, lamp manufacturer; C. F. Bell, 35, Thornton Avenue, S.W.2, chartered secretary; also two ladies and one clerk. Minimum cash subscription 7 shares. The first directors are: A. H. Marker, C. T. Hilder, and W. Best. Registered office: Salisbury House, E.C.

J. A. Kinnaird & Co., Ltd. (10,760).—Private company. Registered November 18th. Capital, £25,000 in £1 shares; 10,000 pref., 14,900 pref. ordinary, and 100 deferred. To take over the business carried on in Greenock as J. A. Kinnaird & Co., electrical and mechanical engineers, &c. Subscribers (each with one share) are: A. Henderson, Sandyford, 20, Stewarton Drive, Cambuslang, electrical engineer; H. S. Kennedy, Aros, Prospect Avenue, Cambuslang, electrical engineer; J. Aithen Kinnaird, 39, Robertson Street, Greenock, electrical engineer; W. S. Sharp, 13, Caddelhill, Greenock, chartered accountant. First directors: A. Henderson, H. S. Kennedy, J. A. Kinnaird, and W. Sharp. Solicitor: W. J. Guild. Registered office: 10, Blythswood Square, Glasgow.

Wallis & Watson, Ltd. (161,048).—Private company. Registered November 27th. Capital, £10,000 in £1 shares. To carry on the business of electrical engineers, &c., and to acquire the business carried on at Park Row, Leeds, as "Wallis & Watsons." The subscribers (each with one share) are: E. C. Wallis, 26, Park Row, Leeds, electrical engineer; G. F. Davidson, 26, Park Row, Leeds, manager. Governing director: E. C. Wallis. Solicitor: R. G. Emsley, Atlas Chambers, Leeds.

A. Verey & Co., Ltd. (161,137).—Private company. Registered November 29th. Capital, £1,000 in £1 shares. To carry on the business of electricians, electrical and mechanical engineers, &c. The permanent governing directors are: Lieut. G. H. Verey, 205, Castelnau, Barnes, S.W. A. K. Verey, Parkstone, Atlas Road, St. Margarets-on-Thames. Registered office: 32a, Bow Lane, E.C.

Fitments, Ltd. (160,909).—Private company. Registered November 24th. Capital, £2,000 in £1 shares. Objects: To take over an agreement between A. S. Cubitt and J. W. Ellingham for the purchase of an invention relating to improvements in shade tilting devices, and to carry on the business of manufacturers of accessories, fittings, machinery, tools, implements, &c. The subscribers (each with one share) are: W. S. Brown, 58, Spital Street, Dartford, builder; G. W. Webb, Brooklands, Dartford, engineer; C. Burwell, 76, Hawley Road, Wilmington, builder; J. W. Ellingham, Cold Blow, Bexley, contractor. The first directors are: W. S. Brown, G. W. Webb, C. Burwell, and J. W. Ellingham. Qualification, 50 shares. Secretary: W. S. Brown. Registered office: 58, Spital Street, Dartford.

Dowding & Mills, Ltd. (160,837).—Private company. Registered November 21st. Capital, £3,000 in £1 shares. To take over the business of manufacturing electrical and mechanical engineers carried on by W. H. P. Dowding, H. L. Mills, and R. Lowe, as "Dowding & Mills," at 193, Camp Hill, Bordesley, Birmingham. The subscribers (each with one share) are: H. L. Mills, 15, Ryland Road, Sparkhill, Birmingham, electrical engineer; E. B. Dinenage, 199, Slade Road, Erdington, Birmingham, electrical engineer. The first directors are: W. H. P. Dowding, H. L. Mills, R. Lowe, and E. B. Dinenage (all permanent). Qualification, 200 shares. Registered office: 193, Camp Hill, Bordesley, Birmingham.

Electrical & Engineering Development, Ltd. (160,991).—Private company. Registered November 26th. Capital, £10,000 in 9,500 8 per cent. cumulative preference shares of £1 each and 10,000 founders' shares of 1s. each. To carry on the business of manufacturers, repairers, importers, and exporters of and dealers in electrical devices and materials, &c. The subscribers (each with one preference share) are: E. Schattner, 117, Corringham Road, Golders Green, electrical engineer; E. A. Godson, 48, Cranley Gardens, South Kensington, S.W., barrister; D. J. Longden, 60, Queensborough Terrace, W.2, accountant. The first directors are: E. Schattner, E. A. Godson, and D. J. Longden. Secretary: D. J. Longden. Registered office: 35, Copthall Avenue, E.C.

National Meter Co., Ltd. (160,884).—Private company. Registered November 22nd. Capital, £10,000 in £1 shares. To take over the business carried on by H. A. Moore as the "National Meter Co.," and to carry on the business of manufacturers of and dealers in petrol, oil, water, and other meters, electrical and mechanical engineers, &c. The subscribers (each with one share) are: C. J. S. Harper, 10-12, Bishopsgate, E.C., solicitor; F. P. Winterbotham, 10-12, Bishopsgate, E.C., solicitor. The first directors are: H. A. Moore and H. M. Piper. Registered office: 25, Victoria Street, S.W.

James Edgar, Ltd. (10,768).—Private company. Registered in Edinburgh November 22nd. Capital, £200,000 in £1 shares. To carry on the business of electricians, electrical and mechanical engineers, &c. The first directors are: J. Edgar, 31, Glendevon Place, Murrayfield, Edinburgh, electrician; R. M. Brown, 17, Lockerton Gardens, Edinburgh, paper box manufacturer. Registered office: 4, Drumsheugh Place, Edinburgh.

J. G. Jackson, Ltd. (10,767).—Private company. Registered in Edinburgh November 22nd. Capital, £200,000 in £1 shares. To carry on the business of manufacturers and brokers of, agents for, and dealers in milling machinery and implements, electricians, electrical engineers, &c. The subscribers are: J. G. Jackson, 16, Linn Terrace, Muirend, Glasgow, engineer; J. Rish, 32, Murrayfield Road, Edinburgh, distillery consultant. The first directors are: J. G. Jackson, J. Rish, W. Duncan, J. Gray, and J. Inglis. Registered office: Constonholm Works, Pollokshaws, Glasgow.

Rawlplug Co., Ltd. (160,817).—Private company. Registered November 20th. Capital, £50,000 in £1 shares (20,000 ordinary, 15,000 cumulative 8 per cent. first preference, and 15,000 8 per cent. cumulative second preference). To carry on the business of manufacturers of and dealers in wall plugs, tools, &c. The subscribers (each with one ordinary share) are: J. J. Rawlings, Rosindall, Westcliff Parade, Westcliff-on-Sea; L. Tweedie-Smith, "Craigleith," Kersfield Road, Putney, S.W. The first directors are: J. J. Rawlings and L. Tweedie-Smith, and others to be appointed by the subscribers. Secretary (pro tem): J. Kirkham. Registered office: 95, Gloucester Road, South Kensington, S.W.

Lodge Plugs, Ltd. (160,881).—Private company. Registered November 22nd. Capital, £300,000 in £1 shares. To take over the business of manufacturers of and dealers in sparking plugs and electric appliances and apparatus carried on at Rugby by the Lodge Sparking Plug Co., Ltd. (now in liquidation), and to enter into an agreement with the said old company and F. B. Lodge, the liquidator thereof. The subscribers (each with one share) are: B. Hopps, St. Peter's Road, Rugby, engineer; A. M. Lodge, St. Peter's Road, Rugby, engineer. The first directors are to be divided into group "A," representing the holders of shares numbered 1 to 125,000, group "B," representing holders of shares 125,001 to 250,000. The "A" and "B" directors may appoint one other director to be classed as "C." The first directors are: J. A. Hopps and B. Hopps (group "A"), and F. B. Lodge and A. M. Lodge (group "B"). There are certain restrictions on transfers of shares which "shall remain in operation during the lifetime of any of the lineal descendants of His late Majesty King Edward VII living at the date of registration of the company, and for 21 years after the death of the last survivor of such descendants but not subsequent thereto." Solicitors: Pinsent & Co., Birmingham.

Taylor & Allen, Ltd. (161,082).—Private company. Registered November 28th. Capital, £5,000 in £1 shares (2,500 7 per cent. preference). Objects: To take over the business of electrical engineers, iron-founders, boiler makers, brass founders, and agricultural implement makers, carried on by T. E. Taylor and J. C. Allen, at 28a, Oriel Road, Bootle, as Taylor, Allen & Co. The subscribers (each with one share) are: T. E. Taylor, 25, Sycamore Road, Waterloo, Lancs., electrical engineer; J. C. Allen, 327, Sutherland Road, Bootle, mechanical engineer. The first directors are: T. E. Taylor (chairman), J. C. Allen, and J. Taylor. Qualification 250 ordinary shares. Registered office: 28a, Oriel Road, Bootle.

Rayner & Heald, Ltd. (161,102).—Private company. Registered November 28th. Capital, £10,000 in £1 shares. Objects: To take over the business of electrical engineers carried on as Rayner & Heald, at Duke Street, Derby, and to enter into an agreement with W. H. Platts. The subscribers (each with one share) are: P. Bedford, Bryn Arvon, Cross Road, Idle, Bradford, C.A.; L. F. Bundle, Rooms Lane, Morley, Leeds, accountant's clerk. The first directors are: W. H. Platts (permanent governing director, subject to holding 1,000 shares), D. D. Raynor, and J. R. Heald. Qualification £1,000. Registered office: 10, Park Row, Leeds.

Leeds Alliance Electrical Manufacturing Co., Ltd. (161,069).—Private company. Registered November 28th. Capital, £5,000 in £1 shares (2,500 6 per cent. cumulative preference). To take over the business of a manufacturer of electric batteries and other electrical appliances carried on by W. A. Davies at Leeds as the Leeds Electrical Manufacturing Co. The subscribers (each with one ordinary share) are: C. E. Morris, 68, Dragon Parade, Harrogate, retired builder; G. Higginbottom, 14a, Baxtergate, Doncaster, engineer. First directors: W. A. Davis (permanent), G. Higginbottom, C. E. Sheard, C. E. Morris, and A. H. G. Mowatt. Qualification £100. Solicitor: C. E. Warren, 61, Albion Street, Leeds. Registered office: Woodhouse Chambers, Coronation Street, Leeds.

Star Electrical Accessories, Ltd. (161,256).—Private company. Registered December 3rd. Capital, £10,000 in £1 shares (5,000 7½ per cent. cumulative preference). Objects: To carry on the business of electrical, civil and sanitary engineers, electricians, &c. The subscribers (each with one share) are: A. G. M. James, Oakhurst, Streetbrook Road, Solihull, manufacturing jeweller; R. H. Lamb, Roseleigh, Yardley Road, Acocks Green, electrical engineer. A. G. M. James signs as director. Qualification 100 shares. Registered office: 13, Frederick Street, Birmingham.

Ponsford & McHardy, Ltd. (10,775).—Private company. Registered November 20th. Capital, £4,000 in £1 shares (2,000 preference and 2,000 ordinary). To carry on the business of electricians, electrical, mechanical, and motor engineers, &c. The subscribers (each with one share) are: S. Ponsford, 3, Rugby Terrace, Broughty Ferry, electrical engineer; J. G. McHardy, Brotckie Place, Broughty Ferry, electrical engineer; S. J. Ponsford, 3, Rugby Terrace, Broughty Ferry, electrical engineer. The first directors are: S. Ponsford, J. G. McHardy, and S. J. Ponsford. Qualification, the holding of 200 ordinary shares. Secretary: S. J. Ponsford. Registered office: 58, Gray Street, Broughty Ferry.

Wells, Rayner & Co. (1919), Ltd. (161,174).—Private company. Registered December 1st. Capital, £2,000 in £1 shares. To carry on the business of electrical and mechanical engineers, &c. The first directors are: A. W. McClellan, Newstead, Eastcote, Middlesex, chairman of Motor Workers, Ltd.; R. W. Gostick, Fountain House, Hockley, Essex, director of Hudson, Sheed & Towell, Ltd. Solicitor: G. A. Jones, 10, Norfolk Street, W.C. Registered office: 56, Paddington Street, Marylebone, W.

George Airey & Co. (Electricians), Ltd. (161,118).—Private company. Registered November 29th. Capital, £1,000 in £1 shares. Objects: To take over the business of electrical engineers and contractors carried on by G. Airey and H. Robson at 25, King Street, Sheffield, as George Airey & Co. The subscribers (each with one share) are: G. Airey, 60, Brocco Bank, Sheffield, electrical engineer; H. Robson, 85, Tadcaster Road, Sheffield, electrical engineer. The first directors are not named. Registered office: 25, King Street, Sheffield.

Owen Magnetic Transmission Syndicate, Ltd. (161,159).—Private company. Registered December 1st. Capital, £12,000 in £1 shares. Objects: To finance the acquisition and sale of patents and to promote companies for this purpose. Other powers taken include promoting of rubber and oil companies, dealing in patent medicines, and publishing newspapers. The subscribers (each with one share) are: J. L. Crown, Gwydyr Mansions, Hove, Sussex, gentleman; A. S. Rosey, 4, Chichester Road, Paddington, W., gentleman; P. Baxter, 1, Western Esplanade, Hove, Sussex. The subscribers are to appoint the first directors. Secretary: G. Elliott. Solicitor: A. P. Paine, 20, Essex Street, W.C.

Mosses & Mitchell, Ltd. (161,127).—Private company. Registered November 29th. Capital, £35,000 in £1 shares. To take over the business of dealers in vulcanised fibre, &c., carried on at 122-4, Golden Lane, and 34-8, Banner Street, E.C., as Mosses & Mitchell, and to carry on the business of manufacturers of and dealers in "Vulmoe" and other vulcanised fibre, Emanden steam jointing, asbestos, insulating materials, motor car and engine accessories, &c. The first directors are: J. Wood, Lock View, Cookham, Maidenhead; J. G. Moore, 110, Wyatt Park Road, S.W.2; W. P. Dunfoy, 10, Ederline Avenue, S.W.16. J. Wood and W. P. Dunfoy are also directors of the Ivory Electrical Co., Ltd. Registered office: 122-4, Golden Lane, Barbican, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electric Welding Co., Ltd. (31,364).—Capital, £460,000 in 45,000 ordinary and 1,000 founders' shares of £10 each. Return dated November 20th, 1919; 22,417 ordinary and 917 founders' shares taken up. £10 per share called up on 14,084 ordinary and 917 founders; 8,333 ordinary considered as fully paid. Mortgages and charges, £22,400.

Petters Ventilating & Engineering Co., Ltd.—Debentures to secure all moneys due or to become due from company to Barclay's Bank, Ltd., registered October 17th, 1919, charged on the company's undertaking and property, present and future, including uncalled capital.

Pacific & European Telegraph Co., Ltd. (36,683).—Capital £100,000 in £10 shares. Return dated November 18th, 1919. All shares taken up. £4 per share called up. £40,000 paid. Mortgages and charges £66,800.

New St. Helens & District Tramways, Ltd. (591,126).—Capital, £150,000 in 20,000 preferred and 10,000 ordinary shares of £5 each. Return dated November 7th, 1919. 15,980 preferred and 9,000 ordinary shares taken up. £128,410 paid, including £510 on 1,020 forfeited shares. Mortgages and charges nil.

United Electric Tramways of Caracas, Ltd. (89,642).—Capital, £200,000 in £1 shares. Return dated November 12th, 1919. 170,000 shares taken up. £7 paid, £169,993 considered as paid. Mortgages and charges £156,700.

CITY NOTES.

French Companies.

The Société Industrielle des Telephones reports net profits amounting to 5,005,000 fr. (£200,000) for 1918-19, as contrasted with 6,671,000 fr. (£266,000) in the previous year, and a dividend at the rate of 35 fr. (£1 8s.) per share has been declared.

The shareholders in the *Société des Forges et Acieries Electriques Paul Girod* have just approved an increase in the ordinary share capital from 22,500,000 fr. to 30,000,000 fr. and the issue of a loan amounting to 12,500,000 fr. in order to continue the programme of extending the use of hydraulic power. When completed the company will have 128,000 H.P. installed for the delivery of 446,000,000 KW. hours per annum.

The Société des Accumulateurs Electriques (late A. Dinin), of Nanterre, Department of the Seine, reports that as a result of the productive developments undertaken for the purpose of the national defence the company was now able to meet a considerable demand, and the orders received approach the highest figures attained during the war. At the recent meeting, when accounts were submitted for the 18 months ended June 30th, 1919, a dividend at the rate of 45 fr. (normally £1 16s.) per share was declared out of net profits of £99,000 on an ordinary share capital of £120,000.

The report of the *Compagnie Electro-Métallurgie de Dives*, dealing with the year ended on June 30th, 1919, states that the year was almost entirely a period of transition, influenced by the uncertain term of the end of hostilities and by the armistice. The Government orders slackened in October, and

were suspended in December, and the resumption of ordinary manufactures was at once taken into consideration. In some of the shops the work of reorganisation was carried out rapidly, but in others, as for instance the department for electrolysis, several months were required in order again to be able to supply tubes to customers. The production was now becoming satisfactory, although the transport crisis caused difficulties in the supply of coal and coke and the conveyance of finished products. The situation of the subsidiaries —the Société Hydro-Electrique et Métallurgique du Palais and the Société du Duralumin—was normal. After making provision for depreciation, the accounts show net profits and balance forward of 4,143,000 fr. (pre-war £165,000), and a dividend at the rate of 60 fr. (£2 8s.) per share has been declared, being the same rate as in 1917-18.

Prospectuses.—*London Electric Wire Co. & Smiths, Ltd.*—The list is to close on or before December 15th in an issue of 350,000 7½ per cent. cumulative preference shares of £1 each at par. There are no debentures, mortgages or charges of any kind. The whole of the issue has been underwritten. The net profits for the past three years are given thus:—1918, £134,008; 1917, £130,968; 1916, £109,172. The contracts and orders now on hand for the company's specialised products, which are used by electrical manufacturers at home and abroad, far exceed any total previously recorded in the company's history; they are even greatly in excess of the war-time enhanced output. This unprecedented demand is expected not only to continue but to increase, and the company has, therefore, to extend its productive capacity. The proceeds of the present issue will be employed in enlarging Anaconda Works, Manchester, in erecting a new rolling mill on a site acquired at Trafford Park, and in equipping additional shops at Church Road Works, Leyton.

Electro-Bleach and By-Products, Ltd.—The list of applications is to close on December 17th in an offer of 80,000 preference shares of £1 each at 20s. per share, and of 80,000 ordinary shares of 10s. each at 17s. per share. The money will be applied to repayment to Government of a sum advanced for extensions at Middlewich, to purchase of Government buildings and plant at Middlewich, to redemption of outstanding debentures, and to extension and development purposes. A brief report of the speech delivered at the meeting at which the issue was authorised will be found in the Electrical Review for November 21st, p. 663.

Lancashire Power Construction Co., Ltd.—The list closes on the 16th inst. in an issue of 400,000 six per cent. (tax free up to 6s.) cum. convertible first preference shares of £1 each at par.

Mann, Egerton & Co., Ltd.—The list is to close on or before to-morrow, Saturday, in an issue of 95,115 eight per cent. cumulative preference shares of £1 each, at par, in this company. The business was founded over 20 years ago at Norwich, and is well known in the motor engineering and electrical engineering trades. The prospectus states that the value of the contracts and firm orders in the various departments, carried forward on October 1st, 1919, was over £400,000, apart from work in progress at that date. During the first six weeks of the current financial period additional orders exceeding £150,000 in value have been received. The prospects are stated to be most encouraging.

The French Thomson-Houston Co.—The shareholders in the Compagnie Francaise Thomson-Houston recently met in extraordinary general meeting at Paris, when a report was presented in relation to prospective developments. The report recalled the statement made at the preceding ordinary meeting, giving an outline of the new programme, which consists in the specialisation of the various works and their expansion. It is proposed, for instance, to undertake at Saint Ouen the manufacture of heavy plant (Diesel engines, turbo-alternators, and electric motors for locomotives); the centralisation of the construction of transformers will be effected at the works in the Rue Lecourbe, Paris; machines of medium size and traction material for tramways will be produced at the works in the Rue de Vaugirard, Paris; small machines for continuous and alternating current will be turned out in bulk at Neuilly-sur-Marne, small apparatus at Lesquin, and insulating material, &c., at Colombes. On the other hand, the report mentioned that new arrangements have been concluded between the company and the International General Electric Co., of New York, which cover not only machines on the Thomson-Houston system, as originally, but also all branches of the electrical industry which the American company will carry on in the future. The agreement, which will extend to the year 1982, confirms or confers on the French company the right of free use of all existing patents of the General Electric Co. and of its subsidiary or affiliated companies, the right of free cession of all their future inventions, and the exclusive right of construction, working and sale in the countries covered by the agreement. In order to carry out this programme the meeting authorised the increase in the share capital from 120,000,000 fr. to 200,000,000 fr. by the issue of 160,000 new shares of 500 fr. at the price of 630 fr., of which 20,000 shares will be subscribed by the International General Electric Co.

Marconi's Wireless Telegraph Co., Ltd.—In a circular issued to the shareholders the directors state that at the extraordinary general meeting on November 13th it was regarded as inexpedient to distribute a cash bonus to the shareholders, but a promise was made that this should be compensated for by the terms of the issue of the new capital. In fulfilment of this promise the directors have decided to issue the whole of the increased capital to shareholders only at £2 per share premium. This will entitle every shareholder, whether he holds preference or ordinary shares, to secure one new share at the price of £3 for every share he may hold. The new shares will rank for dividends declared in respect of the period commencing January 1st, 1920, but in all other respects will rank *pari passu* with the existing 1,250,000 ordinary shares of £1 each.

"With the considerable additional capital which this issue will provide, and having regard to the immense development of wireless telegraphic and telephonic business throughout the world, the earning powers of the company should be greatly enhanced. The directors are confident that the profits of the current year will justify them in maintaining the rate of dividend, and there is every reason to hope that the increase in the capital of the company should at least produce a proportionate increase of profits in future years."

The directors have now issued notices to the shareholders offering them 1,500,000 new ordinary shares of £1 each at £3 per share in proportion to their respective holdings, one new share for each ordinary or preference held. Acceptances have to be received by December 19th.

Eastern Telegraph Co., Ltd.—Revenue for 1918, £3,365,050; ordinary expenses, £889,233; expenditure relating to maintenance of cables, differences in exchange, income and war taxes payable abroad, contribution to pension and superannuation funds, depreciation of investments, payments to staff and other war expenses, £664,359. Balance, £1,811,458. Income tax and excess profits duty, debenture interest and preference dividends absorb £1,011,303, leaving £800,155 plus £64,370 brought forward. £500,000 has been placed to general reserve. Four dividends of 1½ per cent. and a bonus of 2 per cent. have been paid on the ordinary shares, making 8 per cent., free of tax. £44,525 remains to be carried forward. Meeting: December 17th.

India Rubber, Gutta Percha & Telegraph Works Co., Ltd.—The accounts for the year ended September 30th, 1919, show that after making provision for doubtful debts and excess profits duty the net profit was £71,913 (against £143,589 in the previous year), plus £90,955 brought forward. The dividend on the preference shares paid in January and July required £12,500, and the interim dividend on the ordinary shares paid in July, £12,500. A final dividend of 15s. per share, free of income tax, on the ordinary shares, now recommended, will make 10 per cent. for the year. Dividends will be paid on 1st prox. The various difficulties arising out of the reconstruction period, in connection with labour, supplies, &c., have had the anticipated effect of reducing the company's output below the war standard, with a corresponding reduction of profit. Annual meeting: December 18th.

Melbourne Electric Supply Co., Ltd.—It is stated that owing to mail delays the accounts for 1918-19 are not yet ready for presentation, but a final dividend of 5 per cent., free of tax, is recommended on the ordinary shares, making 10 per cent. for the year.

United Electric Tramways Co. of Monte Video, Ltd.—According to the *Financier*, no interim dividend is to be paid on the ordinary shares. The interim dividend on the preference shares is postponed until the accounts have been received.

Stock Exchange Notices.—Application has been made to the Committee to appoint a special settling day in:—

Vickers, Ltd.—4,923,901 ordinary shares of £1 each, fully paid (Nos. 7,384,080 to 12,307,980) and 6,845,762 cumulative preference shares of £1 each, fully paid (Nos. 1 to 6,845,762).

The Committee has ordered the undermentioned to be officially quoted:—

Ruston & Hornsby, Ltd.—631,432 ordinary shares of £1 each, fully paid (Nos. 600,001 to 1,231,432).

Western Telegraph Co., Ltd.—First quarterly interim dividend of 3s. per share, free of income tax, for the year ending June 30th, 1920, being at the rate of 6 per cent. per annum.

Yates & Thom, Ltd.—Dividend of 10 per cent. per annum, less tax, on the ordinary shares, placing £10,000 to reserve, and carrying forward £12,106.

Coventry Chain Co., Ltd.—Dividend of 7 per cent., less tax, on the ordinary shares, making 10 per cent. for the year, and a bonus of 5 per cent., less tax.

Lancashire Dynamo & Motor Co., Ltd.—The *Financial Times* states that the directors have decided not to make an interim distribution at present.

Adelaide Electric Supply Co., Ltd.—At a meeting called for December 16th a resolution will be submitted splitting the £5 shares up into £1 shares.

Chile Telephone Co., Ltd.—Interim dividend 3s. per share, free of tax, for the half-year ended September.

Brazilian Traction, Light & Power Co., Ltd.—Cumulative preference dividend of 1½ per cent. for the quarter.

STOCKS AND SHARES.

TUESDAY EVENING.

THE tone of the Stock Exchange markets is decidedly depressed. In some cases this has developed into real flatness. With the near approach of the end of the year, business invariably becomes slacker in the House. In addition, this year there is the acute difficulty in connection with the rates of exchange between this and foreign countries. The labour outlook is not particularly cheering. The outpouring of new issues continues, and underwriters now find themselves undergoing the somewhat novel experience of being left with part of their obligations. Evidently the investor has taken as much as he wants, and needs to be stimulated with particularly attractive offers in order to embark upon fresh adventure just now. Armstrong underwriters got 50 per cent. of the new shares, and the price of the ordinary, issued at 32s. 6d., fell away to 30s., while the preference, offered at 17s., dropped to 15s. 6d. The Newcastle-upon-Tyne Electric underwriters received 48 per cent. of their contracts, and in consequence the price promptly fell to 1s. 6d. discount. Nevertheless, it is freely stated that a good many other new issues are on the way, likely to make their appearance before the holidays. Those who were asking when the General Electric might be expected to appear on the scene with a fresh scheme are not quite so vocal as they were a week or fortnight back.

All these influences press hardly upon the prices of existing securities. The Government has been supporting the War Loan and some of the other war issues, although it may be noticed that the National War Bonds remain at low levels. Re-adjustment of taxation is a subject of wide discussion. Those who profess to be in the know prophesy that the Government intend to take as a basis for taxation the capital in a business, and, after allowing 10 per cent. profit on the amount, to claim that of the balance, 60 per cent. shall go to the owner and 40 per cent. to the revenue. In other words, a levy on capital under a different name. What truth there may be in the gossip it is impossible to say, but that the Chancellor of the Exchequer's proposals next April will assume something of this shape is generally expected. The result is thought likely to be a good deal of re-arrangement of capital amongst existing companies, and the fashion of distributing reserve funds in the shape of shares, either by way of bonus or at comparatively low prices, may be continued well into the New Year.

The House of Lords is now the buttress for the hopes of those who condemn the Government's Electricity Supply Bill. Evidently the Lords are by no means satisfied with the financial proposals, and the debate in the Upper House was awaited with eagerness by those who are interested in the electric lighting industry. The Bill was duly read a second time last Monday, after protests. Meanwhile prices show heaviness. Metropolitans and Westminsters, amongst the West-End shares, have receded, while Charing Cross ordinary are also ¼ down. There is, however, a readiness to pick up City shares if they come in cheaply. In the provincial group the only item of interest is that provided by the issue of Newcastle-on-Tyne preference, reference to which has been made above.

There is no strength shown amongst Home Railway stocks. Underground Electric income bonds exhibit a drop of 3 on the week, and the shares are also flat. Hints as to the present selling being partly on behalf of German holders receive no particular credence, but are listened to with interest. The shares gave way in sympathy with most of the other speculative divisions round the Stock Exchange. Districts and Metropolitans are a dull market, and so far as the near approach of the dividend season is concerned, it may be remarked that many years have elapsed since so little attention was paid to Home Railway stocks at this season of the year.

Marconi shares are now quoted ex rights. On the basis of 5¼, the quotation ruling at the end of last week, the rights were valued at about a guinea, but upon Marconis going ex rights, the old shares fell to a shade below £4. A market in the new shares was to have been started on the Thursday in this week. Ordinary and preference shareholders have equal participation. American Marconis have given way to a little under 30s., while Marines have dropped to 2¾. Other wireless shares in the group have been equally heavy.

The Chili Telephone Co. is about to issue one new share at the par value of £5 for every eight shares at present held. This has had no effect upon the price, which remains at 6¼. Cable shares have yielded ground a trifle. Westerns and the Eastern group are no longer supported by a phalanx of buying orders, and prices are about 2s. 6d. down. The purely American group has advanced, owing to the further fall in the rate of American exchange, an influence which has a similar bearing upon other stocks and shares connected with the electrical industries in the United States. Brazilian Tractions lost 2 points, notwithstanding the strength of the Brazilian milreis, while in the Mexican group the acute flatness continues, despite rumours that the differences between the United States and Mexico, which threatened to bring both countries to the verge of hostilities, are somewhat less pressing at the moment. Anglo-Argentine Tramways first preference rallied to 3⅛, but the other issues are lower. Calcutta Tramways have gone back to 7⅛, City of Buenos Ayres Tramways to 3 15-16. In the Home list, falls have occurred in British Electric Traction ordinary at 38 and in the preference at 70. London and Suburban Traction have given way to the nominal price of 1s. 6d.

India-Rubber shares at 18¾ are 5s. higher, although the report shows that the net profit for the year (£72,000) is but half that for the preceding twelvemonth. The dividend is maintained at 10 per cent., tax free; the reserve gets nothing this year, as against £50,000 for 1918. More remarkable still is a rise of 7s. 6d. in Castner-Kellners to 3. The dividend has just been reduced from 20 per cent. to 13 per cent., and the demand for the shares is surprising enough to arouse guesses at unexpected developments to come. General Electrics are 6d. harder. Siemens have dropped back to 26s. 6d., and Babcocks at 3⅛ are ⅛ lower. A few other small declines have taken place in the manufacturing department.

Amongst the new issues, the 7½ per cent. cumulative preference shares of the London Electric Wire and Smith's, Ltd., deserve a welcome. The prospectus is well and fairly framed, and the shares offer an excellent investment, soundly secured. The subscription lists are due to close next Monday, but it would not be surprising if this were ante-dated. The rubber share market is heavy in company with most of the other industrial sections round the House. One of the features during the slump of the last few days is the manner in which many first-class debenture stocks have started to dwindle in price—plain witness to the effect of the new issue flood.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1917.	Dividend 1918.	Price Dec. 9, 1919.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	10	8	8⅝	—	£7 2 3
Charing Cross Ordinary	4	4	2¾	— ¼	7 1 7
do. do. do 4½ Pref.	4½	4½	3	—	7 10 0
Chelsea	5	3	3	—	5 0 0
City of London	8	8	11⅜	—	6 17 8
do. do. 6 per cent. Pref.	6	6	9½	—	6 9 9
County of London	7	7	9½	—	7 11 4
do do. 6 per cent. Pref.	6	6	9½	—	6 9 9
Kensington Ordinary	7	6	4½	—	6 6 4
London Electric	Nil	Nil	1½	—	
do. do. 6 per cent. Pref.	5	6	8½	—	8 17 10
Metropolitan	4	5	3¼	— ¼	8 0 0
do. 4½ per cent. Pref.	4½	4½	3⅛	—	7 4 0
St. James' and Pall Mall	9	10	6	—	8 6 8
South London	5	5	2½	—	7 8 6
South Metropolitan Pref.	7	7	1	—	7 0 0
Westminster Ordinary	9	8	5½	— ½	7 12 5
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	20½	—	6 12 8
do. Def.	1½	33/8	22	—	7 11 0
Chile Telephone	8	8	6¼	—	6 3 1
Cuba Sub. Ord.	7	7	10½	—	*8 13 4
Eastern Extension	8	8	16⅝	— ¼	*4 17 7
Eastern Tel. Ord.	8	8	168½	—	*4 15 0
Globe Tel. and T. Ord.	7	8	16½	—	*4 18 6
do. do. Pref.	6	6	10	— ½	6 0 0
Great Northern Tel.	22	22	264	—	8 6 0
Indo-European	13	13	48½	—	6 13 4
Marconi	20	25	3 3/16xr	— ⅛	6 7 0
Oriental Telephone Ord.	15	10	2⅜	—	4 14 1
United R. Plate Tel.	8	8	7⅝	— ⅛	*5 3 5
West India and Panama	1/8	1/8	1⅛	—	Nil
Western Telegraph	8	8	17½	— ½	*4 12 9
HOME RAILS.					
Central London Ord. Assented	4	4	58½	—	6 16 9
Metropolitan	1	1½	23¾	— ½	5 6 5
do. District	Nil	Nil	20¾	—	Nil
Underground Electric Ordinary	Nil	Nil	2	— ½	Nil
do. do. "A"	Nil	Nil	6/-	- 6d.	Nil
do. do. Income	4	5	84	—3	*6 0 6
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4½	—	7 1 2
Anglo-Arg. Trams. First Pref.	6½	Nil	3¾	+ ¼	—
do. do. 2nd Pref.	—	—	3¼	— ¼	—
do. do. 5 Debs	5	5	65	—1½	7 13 10
Brazil Tractions	—	—	61½	—2	—
Bombay Electric Pref.	6	6	13½	—	4 9 0
British Columbia Elec. Rly. Ptce.	5	5	59⅝	—	8 8 0
do. do. Preferrred	Nil	2½	49⅝	—	5 5 3
do. do. Deferred	Nil	Nil	42½	—1	Nil
do. do. Deb.	4½	4½	61	—	6 19 4
Mexico Trams 5 per cent. Bonds	Nil	Nil	43½	—	Nil
do. 6 per cent. Bonds	Nil	Nil	31	—1	Nil
Mexican Light Common	Nil	Nil	28	—	Nil
do. Pref.	Nil	Nil	25	—	Nil
do. 1st Bonds	Nil	Nil	54½	—	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	3⅛	— ⅛	*4 16 0
British Aluminium Ord.	10	10	1⅞	—	6 8 0
British Insulated Ord.	25	12½	2⅝	—	6 1 1
Callenders	25	25	8½	—	7 9 3
" 6½ Pref.	5	6½	4⅞	— ⅛	6 16 10
Castner Kellner	25	20	3	+ ¾	4 6 8
Crompton Ord.	7	10	21/6	—	9 6 0
Edison-Swan, "A"	—	10	1⅝	—	8 8 6
do. do. 5 per cent. Deb.	4	5	81½	—	6 2 9
Electric Construction	10	10	1¼	— ⅛	8 17 10
Gen. Elec. Pref.	6	6½	1	—	6 10 0
do. Ord.	10	10	40/6	+ 6d.	*4 18 9
Henley	25	25	2¼	—	5 11 1
do. 4½ Pref.	4½	4½	3⅛	—	6 4 2
India-Rubber	10	10	18¾	+ ¼	*5 6 8
Met.-Vickers Pref.	—	—	2½	—	5 14 0
Siemens Ord.	—	10	26/6	—1/6	*7 11 0
Telegraph Con.	20	20	35½	—	*4 16 0

* Dividends paid free of Income Tax.

THE "FUEL OF THE FUTURE" AND THE GAS COMPANIES.

By B. L. KLEMENS.

In a former article by the same author, it was shown how entirely erroneous and misleading was the British Commercial Gas Association's advertisement under the above title, inasmuch as, when the consumer used the gas for cooking, and the coke for heating (which manner of use is more favourable to gas than any other), he was able to utilise, not 70 per cent. or 80 per cent. as claimed, but a bare 14·66 per cent. of the original calorific value of the coal.

It is regretted that by an unfortunate error the case as set out in the former article appears more in favour of the gas companies than it really is. It was stated that Sir Dugald Clerk gave the efficiency of conversion as 25 per cent., and that for every 100 B.TH.U. employed at the gas works, 3·4 could be applied in the oven. Just previous to this, he stated that if all the heat used for generation, &c., were debited to gas, and the coal entirely converted into gas leaving no residue of coke or tar, its efficiency of conversion would be 46 per cent., and it is on this figure that he is working. Therefore, the 100 B.TH.U. at the gas works became 46 B.TH.U. delivered to the consumer, and of these only 3·4 are really used in the oven.

Consequently, the oven efficiency = 3·4 × 100/46 = 7·4 per cent.

Taking also his figure for boiling (22·5 B.TH.U. actually utilised out of each 100 at the gas works), then the boiling ring efficiency = 22·5 × 100/46 = 49 per cent.

From this we see that gas, when used for cooking, has an overall efficiency of only 28·2 per cent.

Allowing for this correction as regards the gas efficiency, the 70 or 80 per cent. dwindles to 13·77 per cent., instead of 14·66 per cent. as erroneously stated in the former article.

In only one case were figures of Sir Dugald Clerk used, and then not with any idea of refuting them. However, as that gentleman repeated his lecture of March last practically verbatim to the British Commercial Gas Association at its recent meeting, it is time that some statement were produced for the benefit of those who, well knowing the figures to be untrue, are without the time, or, perhaps, the special knowledge, necessary to disprove them.

The original lecture is most cleverly planned, so that those with no technical knowledge are led to believe that by the use of gas only half as much coal is destroyed as is the case when electricity is used. Those with slight technical knowledge, who were hoping to find the figures wherewith to check Sir Dugald's results, sought them in vain, for although he practically admitted early in the lecture that even with such a low electrical efficiency as 8·5 per cent., gas for lighting purposes required over one and a-half times as much coal as electricity, he made no use of the figures, but proceeded to deal with a number of problematical points regarding the future manufacture of gas. Sir Dugald next proceeded to state that on the present basis of manufacture, electricity uses 2·65 times more coal than gas uses, the comparison as regards lighting being arrived at by averaging the amount of gas burnt with upright and inverted burners respectively, and comparing this with the electricity consumed by the one-watt lamp. He followed on with the further dubious statement that the inverted burner will come into universal use in gas lighting of the future, while the *one-watt* electric lamp will also become *practically so.*

It is surprising that one with the scientific knowledge of Sir Dugald Clerk can continually reiterate facts which have no real bearing on the case. In the case of one of less eminence it would, of course, be easy to say that opinions depend on the pocket, but in this case no such suggestion can be entertained, and we are left with the puzzle of how a man with such knowledge can have so absorbed the B.C.G.A. outlook as to have forgotten what he must have learnt as a boy. As has frequently been pointed out, the thermal efficiency of conversion has nothing to do with the matter, or, at least, is so remotely connected therewith as to be of no moment. The gas system might be likened to a man pouring water from a jug. If a two-quart jug, full to the brim, represented the original heat in the coal, the heat in the resultant gas would be represented by a full pint jug, the other three pints having been spilled, and this one pint represents the gas as it is in the gasholder. When the consumer comes to use it, he is supplied with a pint pot which is pierced with holes from the rim downwards for two-thirds of its depth, and into this the pint jug is emptied. According to the gas companies, the consumer then has a pint of water. A milkman who measured our milk in this fashion would make himself decidedly unpopular.

The whole campaign of the gas companies is one of misrepresentation and suppression of vital facts.

Taking an average for the whole country, Sir Dugald states the coal consumption per unit of electricity as being 3·47 lb. per unit. Working on this average, he suggests that it is impossible for the super-stations under the Government Bill to attain an efficiency of 20 per cent., because that is 2·3 times the present average; he does not mention, however, that the greater the output of the station the greater is the efficiency; for instance, there are 380 stations, with an output of 6 million units each, which require 4·32 lb. of coal per unit, while 40 stations, with an output of over 50 million units each, only require 2·57 lb. per unit.

This clearly proves that the efficiency increases as the output increases, a fact which Sir Dugald leaves out of his reckoning.

The suppression of vital facts is, of course, best illustrated in that neither Sir Dugald Clerk nor anyone else connected with the British Commercial Gas Association has ever mentioned that of the heat value contained in gas, only a small proportion is usable, as was illustrated by the jug of water analogy.

In the lecture to the Royal Society of Arts, the application of gas is given as being:—55 per cent. for heating, 35 per cent. for lighting, 10 per cent. for motive power.

Figures regarding the efficiency of gas engines are so variable and unreliable that it is fairer to the gas companies to consider that all gas generated is used for lighting or heating.

The proportions would then be:—60 per cent. for heating, 40 per cent. lighting.

That is, out of 30,000 cb. ft. generated by the destruction of 2 tons of coal, there would be used:—18,000 cb. ft. for heating, 12,000 cb. ft. for lighting. 18,000 cb. ft. of gas represent 8,640,000 B.TH.U., but, as we see from the Gas Co.'s own figures, only 28·2 per cent. of this can be used. So that the net amount of heat actually and usefully employed is 2,436,480 B.TH.U.

Electricity can be used for cooking and heating purposes with an average efficiency of 90 per cent., so that this amount of work could be done by electricity equal to 2,707,200 B.TH.U. instead of the gas equivalent of 8,640,000 B.TH.U.

As regards lighting, the inverted gas mantle requires 47 B.TH.U. at the gasworks per candle-hour, while the upright requires 82 B.TH.U. per candle-hour. If we accept Sir Dugald Clerk's statement that about half of each type are used, and that the efficiency of conversion is 46 per cent., we find that we require gas equal to—

$$0{\cdot}46 \times 129/2 \text{ B.TH.U. per candle-hour,}$$

and that 12,000 cb. ft. of gas would yield—

$$12{,}000 \times 480 \times 100 \times 2/129 \times 46$$

candle-hours = 194,135·5 candle-hours.

He also gives 54 B.TH.U. as the energy necessary at the electricity works per candle-hour to run a one-watt lamp, and 31 B.TH.U for a so-called half-watt, and the efficiency of conversion as 8·5 per cent.

Taking the average for the two types of lamps, as he did in the case of the two different gas burners, 85/2 B.TH.U. are required at the works per candle-hour, or, at a conver-

sion efficiency of 8·5 per cent., electricity equal to 85 × 8·5/100 × 2 B.TH.U. = 3·6125 B.TH.U. per candle-hour.

This figure cannot be accepted, however, for the one-watt lamp only consumes one watt per candle-hour, and, unfortunately for Sir Dugald Clerk, the watt, unlike a cubic foot of gas, has a fixed heat equivalent, depending on natural laws, and not variable by statute or Orders in Council. The equivalent of one watt for one hour is 3·412 B.TH.U., and at a conversion efficiency of 8·5 per cent. this would mean 40 B.TH.U. per candle-hour at the electricity works. If it is assumed that the so-called half-watt lamp, which usually consumes about 0·66 watt per candle-hour, actually takes 0·75 watt, the average per candle-hour would be 2·985 B.TH.U., and 194,135·5 candle-hours (the yield of 12,000 cb. ft. of gas), would be given by electricity equivalent to 194,135·5 × 2·985 B.TH.U. = 579,495 B.TH.U.

Allowing the Gas Co. to deduct the total heat value of the coke products (6,600,000 B.TH.U.) and tar products (2,912,000 B.TH.U.), the manufacture of 30,000 cb. ft. of gas has involved the total destruction of 58,240,000 B.TH.U. (the calorific value of 2 tons of coal), less the sum of the coke and tar products, 9,512,000 B.TH.U., *i.e.*, the actual net destruction of coal equivalent to 48,728,000 B.TH.U.

On the other hand, it has been shown that electricity, to produce the same result, requires :—

For lighting	579,495 B.TH.U.
For heating	2,707,200 „
Total passing through works' meters	3,286,695 „

and on the basis of a 20 per cent. conversion efficiency, this represents the destruction of coal at the electricity works equal to—

$$3{,}286{,}695 = 16{,}433{,}475 \text{ B.TH.U.}$$

Before converting these figures into lb. of coal for the purpose of comparison, it is as well to premise that although for this purpose both systems will have to be supposed to use coal of the same thermal value, electricity can use a much lower grade than the gas works, and, indeed, coal that might otherwise be mere waste. For this reason alone, the electricity supply stations are of immense value to the nation.

The gas companies require coal of a calorific value of not less than 13,000 B.TH.U. per lb., so that they must totally destroy

$$48{,}728{,}000/13{,}000 = 3{,}748 \text{ lb. of coal.}$$

The electricity super-stations which Sir Dugald Clerk says will use nearly twice as much coal to do the same amount of work as that done by the gasworks, would, in fact, only require

$$16{,}433{,}475/13{,}000 = 1{,}264 \text{ lb. of coal,}$$

or about one-third of that required for the gas system.

It can now be seen that gas, far from being 3·8 times more efficient than electricity, is actually only 33 per cent. efficient as compared with electricity. That is, if gas is to take the place of electricity for lighting and heating, our national coal supply will disappear nearly three times as quickly as if electricity alone were used.

Even though the 20 per cent. conversion efficiency estimated by the Government advisers is not actually attained, the use of electricity with only 10 per cent. conversion efficiency would still be one-and-a-half times more economical than gas from the national point of view.

Canal Traffic.—Negotiations are proceeding between the Hull dock authorities and the Sheffield Corporation Development Department with a view to reorganising the South Yorkshire Canal system by running motor barges in conjunction with steamers, and so providing Sheffield iron and steel trades with ready access to the North-East Coast. By this scheme the railways would be relieved of 2,000,000 tons of merchandise per year. The promoters also aim at establishing in conjunction with this development a 36-hours' motor-barge through service to Liverpool. An essential condition to the progress of the scheme is the liberation of the canal system from railway control.—*Daily Chronicle.*

NEW ELECTRICAL PROPOSALS FOR PARLIAMENT TO CONSIDER.

We give below a list of the proposals that will come forward in the next session of Parliament. Readers who are desirous of obtaining further information will find the applications published in detail in the *London Gazettes* for November 21st, 25th, and 28th, and December 2nd.

(a) Electric Light and Power.

Abersychan (Mon.).—South Wales Elec. Power Distr. Co., E.L. prov. order, for Urban District of Abersychan.

Ammanford.—Mr. W. Herbert, of Llwynon, Carnarvon.—E.L. prov. order for U.D. of Ammanford, parts of the parishes of Llandybie and Bettws in the R.D. of Llandilofawr, and of the parish of Llanedy; electricity in bulk in the R.D. of Llandelo-fawr, Llanelly, and Pontardawe; supply to railways, tramways, and canals.

Bedwas and Machen.—U.D.C.'s E.L. prov. order.

Blackpool Corporation.—Extension of the borough and township to include Thornton and certain area west of the borough; extension of the electricity supply; construction of new tramways; carriage of goods and minerals on Blackpool and Fleetwood tramroads; motor omnibuses.

Bristol Corporation.—Extension of area of electrical supply; further electrical supply provisions; construction of new tramways, additional tramway provisions.

Coventry Corporation.—Further powers as regards the electric lighting undertaking and construction of new tramways; motor omnibuses; provision for contribution for maintenance of streets and roads, and further tramway powers.

Dartmoor.—New company.—The Dartmoor and District Hydro-electric Supply, power to construct works in Devon for generation of electricity by water power, defining area of supply, &c.

Edmundson's Electricity Corporation, Ltd., &c.—Increase and alteration of prices to be charged by Edmundson's Electricity Corporation, Ltd., the Urban Electric Supply Co., Ltd., and subsidiary companies; repeal and amendment of Acts and orders.

Gelligaer U.D.C.—Further electricity supply powers; motor omnibuses.

Great Northern Railway Co.—Powers to supply and distribute electricity for its own use.

Havant U.D.C.—E.L. prov. order.

Huddersfield Corporation.—Extension of E.L. area to include Kirkheaton, Kirkburton, Lepton, and Meltham.

Mynyddislwyn U.D.C.—E.L. prov. order.

Nanty-glo, Blaina, and Brynmawr U.D.C.'s.—Incorporation of joint board for the generation and supply of electricity in the urban districts of Nanty-glo, Blaina, and Brynmawr.

North Metropolitan Electric Power Supply Co.—Additional capital, extension of supply to Aldenham, Hyde, Cuddington, and U.D. of Willesden; acquisition of other undertakings, &c.

Panteg.—South Wales Electric Power Distribution Co., E.L. prov. order.

Risca U.D.C.—E.L. prov. order.

Saint Mellons.—South Wales Electric Power Distribution Co., E.L. prov. order to supply the parishes of Rogerstone, Machen Lower, Graig, Rumney, Saint Mellons, Peterstone, Wenkloog, Duffryn, Muchaelstone-y-Vedw, Henllys, Marshfield, and Cold Kernen in the R.D. of St. Mollons (Mon.).

South Wales Electric Power Distribution Co.—Further capital (including further issue of prior lien debenture stock) and other financial powers, &c.

Stone (Staffs.).—Stone Gas & Electricity Co., E.L. prov. order.

Sunderland Corporation.—Power to purchase gas undertaking; provisions as to supply of electricity.

Tredegar U.D.C.—Various electricity supply powers.

(b) Electric Tramway, Motor-'bus, and Railless Trolley Vehicles.

Bootle Corporation.—Powers to run motor omnibuses; provisions to require bodies and persons working omnibuses to contribute to maintenance of streets and roads.

Bridlington Corporation.—Powers to run motor omnibuses within and without the borough.

Cardiff Corporation.—Construction of new tramways, reconstruction of old tramways, trailer and coupled cars, motor omnibus powers, further electrical provisions.

Erith U.D.C.—Further tramway provisions; acquisition of tramways; motor omnibuses within and beyond the district.

Folkestone Corporation.—Powers to run motor omnibuses within and without the borough.

Gravesend, Rosherville, and Northfleet Tramways.—Prov. order to increase fares, &c.

Halifax Corporation.—New tramways in the borough and the U.D.'s of Elland and Hebden Bridge, and the parishes of Blackshaw and Erringden; further tramway powers; extension of time for construction of authorised tramways; power to carry minerals and goods; alteration of gauge; extension of area of supply; supply of electricity in bulk; further electrical supply powers.

Hastings Tramway Co.—Additional tramway powers; power to use overhead equipment.

Huddersfield Corporation.—Construction of new tramways in Huddersfield, Fixby, and Brighouse; railways in Huddersfield; motor omnibuses; further tramway powers; additional powers as regards the electricity undertaking.

Leigh Corporation.—Power to run motor omnibuses in the borough and parish of Astley and certain routes in the U.D. of Hindley and parish of Culcheth; additional omnibus routes; leasing of the undertaking, &c.

London, L.C.C.—Construction of new and reconstruction of existing tramways; street widenings, and various incidental powers; motor omnibuses.

London United Tramways.—Various powers, including increase of fares, notwithstanding agreements.

Lowestoft Corporation.—Provision of trolley vehicles and overhead equipment; motor omnibuses within and beyond the borough; further provisions as to tramways, trolley vehicles, omnibuses, and electricity supply.

Lytham U.D.C.—Acquisition of portion of undertaking of Blackpool, St. Annes, and Lytham Tramways, Ltd.; tramway powers; electricity powers; motor omnibuses.

Manchester Corporation.—Extension of time for tramways construction, new tramways, further provisions as to the electricity supply undertaking.

Merthyr Tydfil Corporation.—Power to run motor omnibuses within and beyond the borough.

Metropolitan Electric Tramways, Ltd.—Various powers; extension of time for completion of authorised tramways; increase of fares; completion of certain trolley vehicle equipment; power to use trailers and coupled cars.

Middlesex County Council.—Construction of new tramways in Edgware Road; leasing of tramways to M.E.T., Ltd.; further electrical supply provisions; motor omnibuses.

Newcastle-upon-Tyne Corporation.—Construction of new tramways; additional tramway powers; motor omnibuses; acquisition of undertaking of Tyneside Tramways and Tramroads Co.; contributions by motor omnibus undertakings within the city to cost of reconstruction and maintenance of roads; further provisions as to use of electricity supplied by Newcastle-upon-Tyne Electric Supply Co., or generated by Corporation.

Nottingham Corporation.—Construction of new tramways; further tramway powers; motor omnibuses outside the city.

Pontypridd U.D.C.—Construction of new tramways; further tramway powers.

Portsmouth Corporation.—Extension of the borough to include Cosham and Arlington; construction of new tramways; motor omnibuses; extension of area for supply of electricity; and further powers with reference to electricity undertaking.

Rhondda U.D.C.—Extension of time for completion of tramways; new tramways provisions; motor omnibuses.

Risca U.D.C.—Motor omnibuses within and without the district.

St. Annes-on-Sea U.D.C.—Powers to acquire the Blackpool, St. Annes, and Lytham Tramways Co., Ltd.; new tramways in Lytham; run trailer cars; compulsory running powers over tramways of Blackpool Corporation; motor omnibuses; generation and supply of electricity.

Salford Corporation.—New tramways and tramways reconstruction; trailers and coupled cars; motor omnibuses; further electricity supply provisions.

Sheffield Corporation (two applications).—Construction of new tramways and incidental work; further motor omnibus powers; additional tramway powers.

Southampton Corporation.—New tramways; powers to run motor omnibuses beyond the borough.

South Metropolitan Electric Tramways & Lighting Co., Ltd.—Various powers; increase of fares; power to use trailers and coupled cars; general and incidental provisions.

Stoke-on-Trent Corporation.—Powers to acquire undertaking, &c., of the Potteries Electric Traction Co., Ltd., and tramway undertaking of the North Staffordshire Tramways Co., Ltd.; motor omnibuses within and without the borough.

Sutton Coldfield Corporation.—Motor omnibuses within and without the borough, and to Walsall, Lichfield, and Tamworth, &c.

Swansea Corporation.—Motor omnibus provisions.

Tyneside Tramways & Tramroads Co.—Powers to run motor omnibuses to Seaton Burn, &c.; increase of tramway fares, &c.

Wallasey Corporation.—Motor omnibuses within and without the city; further tramway provisions.

Warrington Corporation.—Construction of new tramways.

Wolverhampton Corporation.—Powers to run motor omnibuses; further tramway and omnibus powers.

Wrexham.—Wrexham & District Transport Co., Ltd.—Further tramway provisions.

(c) Railways, &c.

Central London & Metropolitan District Railway Co.—Power to construct new railway to connect the C.L.R. with the Kensington and Richmond branch of the L. & S.W. Railway at Shepherd's Bush station; and various other powers.

Derby.—Derwent Valley, Calver & Bakewell Railway.—New company to construct and work railway by electric power in the county of Derby.

London Electric, Metropolitan District, City & S. London, and Central London Railway Co.'s.—Various powers, including increase of fares.

Thames Ocean Wharf & Railway.—New company; powers to construct wharf railways and electric generating station, and to supply electrical energy; work railways by electricity; arrangements with Midland and G.E.R., &c.

Application is to be made to the Light Railway Commissioners for the following provisional orders:—

Brighton Corporation.—Construction of light railway in the county borough of Brighton, parish of Patcham, and R.D. of Steyning East.

Middleton.—Middleton Electric Traction Co., Ltd.—Powers to increase fares and charges.

Peterborough Electric Traction Co., Ltd.—Powers to increase fares and charges, &c.

Southend-on-Sea Corporation.—Extension of the light railway, and other powers.

Spen Valley & Morley Light Railway.—Yorkshire (W.D.) electric Tramways.—Powers to increase fares and charges.

Institution of Civil Engineers.—Extension of charter; registration of civil engineers, &c.

CARBON ARCS FOR SEARCHLIGHTS.

By C. C. PATERSON, O.B.E., M.I.E.E.; J. W. T. WALSH, M.A. M.Sc., A.M.I.E.E.; A. K. TAYLOR, M.I.E.E.; and W. BARNETT.

(From the National Physical Laboratory.)

(*Abstract of paper read before the* Institution of Electrical Engineers.)

(*Concluded from page* 713).

The general position may be summarised as follows:—

A long arc, for any given carbon, whether impregnated or not, implies a high potential; and a short arc, a low potential. In order to obtain, under working conditions, a given amount of light from a given positive carbon, it is only necessary to pass through it a given current, the voltage across the arc and the arc length required to avoid hissing being immaterial. A positive carbon taking 200 amperes at 70 volts, *i.e.*, 14 KW., will emit the same light as one taking 200 amperes at 100 volts, *i.e.*, 20 KW. From the point of view of light emission from the positive crater, the extra 6 KW. are wasted. In order to ensure, however, that all but a very small proportion of the light directed towards the mirror from the positive carbon misses the negative, it is necessary for the arc length to exceed a certain minimum figure (for particular diameters of positive and negative carbons), and to obtain carbons which will take the maximum current through the positive crater at this minimum arc length, thus securing all the light possible with the minimum amount of dissipation of heat at the arc.

The above discussion leaves out of consideration any specific differences there may be in the light emission of different carbons, *i.e.*, in the capacity of one type of carbon to give more light than another for a given current.

The whole investigation shows that, for the types of carbon considered, there is no sensible difference either in average candle-power or in crater brightness for carbons of the same diameter run at the same current. The efficiency in candles per ampere, however, increases somewhat for the same current density as the diameter of the positive carbon is increased; it is reasonable to attribute this, at least in part, to the greater relative cooling surface of the smaller carbons.

The above conclusions follow from an examination of the curves. The large curves are for average candles plotted against current; the small curves at the top of the sheets are for crater brightness in candles per sq. mm. plotted against current. Each curve sheet gives for one of the types of carbon the result of a long series of measurements of candle-power and crater brightness at different values of current. The (candle-power)/(current) curve for carbon No. II, when burned with the Yorke electromagnetic control, has been taken as a convenient reference line for purposes of comparison between other carbons, and this has been shown as a broken line on all curve sheets. For crater brightness a dotted reference line has been drawn by connecting two points whose co-ordinates are obtained thus: the abscissæ are the currents corresponding to densities of 0·2 and 0·3 ampere per sq. mm. of the carbon considered, while the ordinates are the crater brightnesses of the reference carbon at the same current densities.

Each circle marked on the curves represents the mean of a large number of observations.

The emission of light from the carbons was liable to vary over a wide range, and no reliable comparison is possible unless the mean of a large number of readings is taken.

Uncoppered carbons (*Nos. I to VII*).—(I) Cored carbon made by the Sautter, Harlé Co., 20 mm. rated at 90 amperes—a relatively high density of 0·29 ampere per sq. mm. This carbon gave uniformly smooth and flexible running without the use of the electromagnetic device.

(II) Fig. 4.—Solid Army carbon (G.E.C. "Apostle" grade) 22 mm., rated at 60 amperes per sq. mm. On the whole, good running was obtained; without the electromagnetic device currents up to 100 amperes could be taken, and with this device it was possible to run up to 130 amperes. The results on this carbon have been used as a reference.

(III) Cored carbon (G.E.C. "Nubia" grade), 23 mm., impregnated with the Heape & Grylls special solution, rated at 110 amperes or a current density of 0·265 ampere per sq. mm. It was found to give good flexible burning with the electromagnetic device.

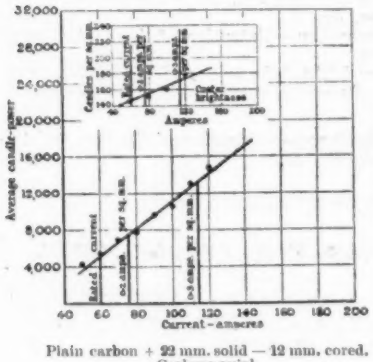
The efficiency of this carbon at an arc length of 20 mm. (7 per cent. obscuration) was 2·0 candles per watt at a current density of 0·3 ampere per sq. mm.

(IV) Same maker as No. I, 24 mm.; rating 75 amperes, or 0·165 ampere per sq. mm. This also gave good burning without the electromagnetic device.

with the expression for candles per ampere given above, it was found that the maximum candles per ampere should be obtained with a positive 34 mm. in diameter, taking some 250 amperes. This gave 124 candles per ampere, a result almost identical with that obtained with the 28-mm. diameter carbon at 154 amperes, viz., 123 candles per ampere.

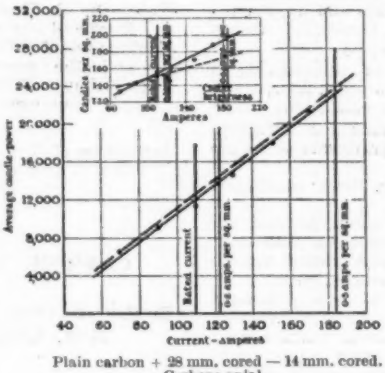
The fact that the candle-power values for each current density lay regularly on a system of straight lines showed that none of these carbons possessed any noticeable superiority in specific light emission. Coppered negatives of smaller diameter could be used with some advantage with Nos. IV and VII, say, 12 and 18 mm. respectively, since this would reduce the obscuration of light.

All the positives were uncoppered, and it was found that as the current density was increased beyond about 0·3 ampere per sq. mm. the carbons became very hot, especially the larger sizes, and began to disintegrate on the outer surface. For further work at high



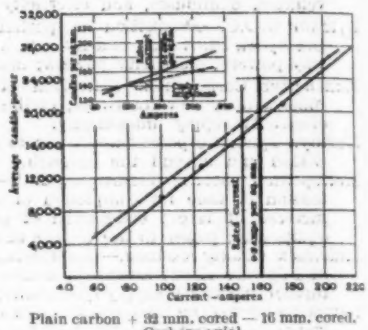
Plain carbon + 22 mm. solid — 12 mm. cored. Carbons axial.

FIG. 4.



Plain carbon + 28 mm. cored — 14 mm. cored. Carbons axial.

FIG. 5.



Plain carbon + 32 mm. cored — 16 mm. cored. Carbons axial.

FIG. 6.

CANDLE-POWER, CRATER-BRIGHTNESS, AND CURRENT CURVES.

(V) Fig. 5.—Navy cored carbon ("Apostle" grade) 28 mm., rating 110 amperes, or 0·18 ampere per sq. mm. This carbon ran very smoothly without the electromagnetic device.

(VI) Fig. 6.—Similar to the foregoing, but 32 mm., rating 150 amperes, or 0·186 ampere per sq. mm. This carbon did not give very good running, as the arc was difficult to control.

(VII) Army solid carbon ("Apostle" grade), 38 mm., rating 150 amperes, or only 0·132 ampere per sq. mm. This arc was often difficult to control, and gave irregular results at currents above 200 amperes.

Fig. 7 gives a set of curves embodying the results of the average candle-power tests on the uncoppered carbons. It is seen that the average candle-power depends only on the current and the nominal area of the positives. The empirical expression obtained for these curves is of the form $c = A\,i + B\,a + C$, which gives the average

current densities, and to use carbons of 28-mm. diameter, therefore, it was decided to have all the positives coppered.

Coppered Carbons (Nos. VIII to XIII).—(VIII) Carbon of 28 mm. diameter, same grade as No. II, but with a copper coating, which enabled this carbon to be run satisfactorily at a higher current density (up to 0·36 ampere per sq. mm.) than solid uncoppered carbons of the same grade.

(IX) Fig. 8.—Carbon of 28 mm. diameter similar to No. VIII but impregnated with the special Heape & Grylls solution and without any coring.

As in the case of No. III, this carbon gave very good and flexible running with the electromagnetic device which was necessary to keep the arc from wandering. This carbon could be run with a very short arc and correspondingly reduced potential difference, though this involved an increased obscuration by the negative

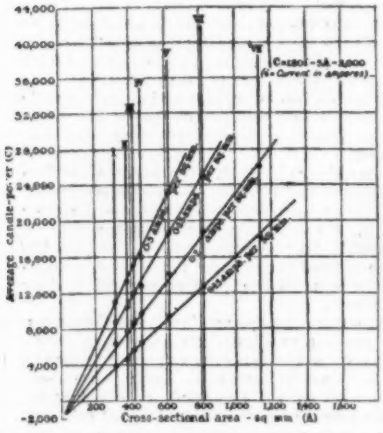
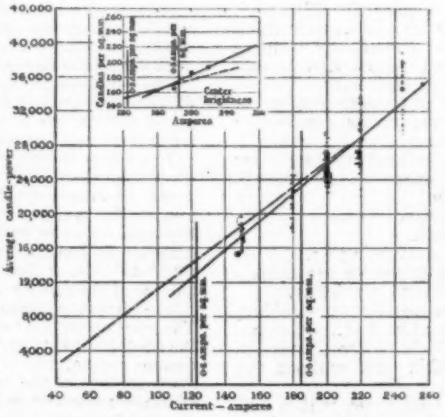
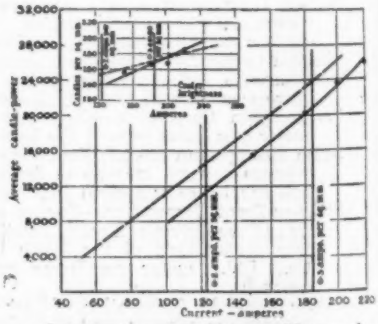


FIG. 7.—AVERAGE CANDLES AND NOMINAL AREA OF UNCOPPERED POSITIVE CARBONS AT FOUR CURRENT DENSITIES.



Impregnated carbon + 28 mm. solid coppered — 16 mm. cored. Carbons axial.

FIG. 8.



Impregnated carbon + 28 mm. solid coppered —16 mm. cored. Carbons axial.

FIG. 9.

CANDLE-POWER, CRATER-BRIGHTNESS AND CURRENT CURVES.

candle-power for any carbon in terms of the current and area, where i is the current and a is the nominal cross-sectional area of the positive in sq. mm. For these carbons A = 150, B = − 5, and C = − 2.000.

Hence it is seen that the average number of candles per ampere tends to increase with the area for a given current density.

No appreciably greater efficiency can be obtained by increasing the diameter of the positive beyond 28 mm.

Further, as a result of this investigation, it was found that the maximum current which any uncoppered carbon could carry without overheating was given approximately, for the sizes used, by the empirical formula—

$$i_{max} = 1{\cdot}8d^{1{\cdot}4},$$

where d was the diameter of the positive in mm. By comparing this

carbon. This carbon was also run without the electromagnetic device, but with the positive rotating at a uniform speed of about one revolution per 2 minutes while the negative was inclined at an angle of some 25° with the horizontal. The effect of removing the electromagnetic control and adding the rotating device was slight, as the latter kept the crater regular.

The efficiency of this carbon was 2·0 candles per watt at a current density of 0·3 ampere per sq. mm. and an arc length of 26 mm. (7 per cent. obscuration).

(X) Solid carbon, 28 mm., harder grade than No. VIII (G.E.C. "Nubia"). The results were similar to those obtained with the No. V. carbons. This grade of carbon tended to chip while burning.

(XI) Fig. 9.—Solid coppered carbon, 28 mm., same as No. X except that it was impregnated with the special solution. There

was no difficulty in burning this carbon at any arc length and the potential difference only varied slightly with the arc length and current.

(XII) Same as No. V except that it was coppered.

(XIII) Cored carbon 28 mm. The running was fairly good.

The thickness of coppering on the carbons VIII to XIII was 0·06 mm. This apparently resulted in an increase in the slope of the (candle-power)/(current) curves, and in shifting the intercepts on the axis of the current. This last was equivalent to an increase in the size of the carbon. It is probable that the relative irregularity of the results was due to the difficulty in maintaining a uniform crater at current densities exceeding 0·3 ampere per sq. mm. Carbon IX had the greatest efficiency in candles per watt, and Nos. IX and XI had the greatest flexibility of burning. At 220 amperes the average candle-power of these six carbons did not differ by more than 13 per cent. from the mean. In all cases the negatives were of 16 mm. diameter and heavily coppered, as it was found that if smaller ones were used the coppering volatilised and the carbon gradually disintegrated and diminished in diameter when the current exceeded 180 amperes.

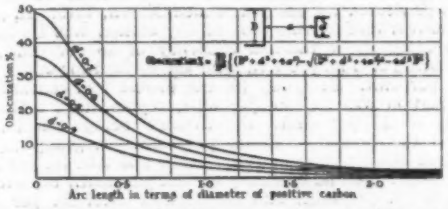


Fig. 10.—Curves Showing Percentage of the Total Light which is Obscured.

At some of the shorter arc lengths employed during the course of the investigation, the proportion of light obscured by the tip of the negative carbon cannot be altogether neglected. The amount of this obscuration can be readily calculated.

Neglecting small corrections, the percentage of the light emitted from a positive crater of diameter D which is obscured by a negative of diameter d at an arc length a is given by the formula :—

$$50\{(D^2 + d^2 + 4a^2) - \sqrt{[(D^2 + d^2 + 4a^2)^2 - 4d^2D^2]}\}/D^2.$$

The values of this expression for different sizes of negative, and at all arc lengths, are given in the curves of fig. 10, where all dimensions are expressed in terms of the diameter of the positive. There is one other consideration which cannot be neglected. For a 35-in. projector of about 16·5 in. focal length, only 70 per cent. of the total light from the crater falls on the mirror. All the obscured part of the light is within the angle embraced by the mirror, so that the effective obscuration of the useful light is 1·4 times that given by the formula.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

NORTH-WESTERN CENTRE.

On Tuesday, November 18th, 1919, Mr. J. A. Robertson, borough electrical engineer, Salford, delivered his inaugural address as chairman. After referring to the struggle of the past five years, and to the memory of those members who had fallen in the war, he urged that they should see that those who returned were reinstated in civil life without suffering any disadvantage on account of the sacrifices they had made. He then dealt with the difficulties under which power stations laboured during the war, and the enormous increase in the use of electricity for ordinary industrial purposes, which had placed it beyond all doubt as the most efficient, reliable, and cheapest form of power. He held that the Ministry of Munitions, which had the responsibility for issuing permits to enable plant to be purchased, carried out its duties with fairness and discretion. It required the strain of this great war to bring the importance of cheap electricity supply into the region of national politics. The first actual step in this direction was the reading of Mr. Williams's paper before the Institution in the early part of 1916. This paper put forward bold comprehensive proposals for national electricity supply under a Board of Commissioners in London. The scheme included the erection of superstations, transmission lines, and supplies in bulk to local authorities over districts to be set up by the Commissioners. At a discussion on the paper in Manchester in April, 1916, Mr. Robertson suggested the linking-up of existing stations as a means of increasing the output from the present plant, and affording reliability of supply. As an outcome of the discussion a committee of engineers was appointed to report on a linking-up scheme for Lancashire and Cheshire. It should be explained why that scheme fell through. In preparing its second report, which was intended to formulate a detailed scheme under central control, the committee felt that to make linking-up effective, a full measure of central control was necessary, including the erection of new stations by the central board. The majority of the committee felt that the report, to be of any value, must put forward a full scheme which would provide not only for linking-up, but for the joint ownership and control of generating stations. The second report was considered at a conference representing 35 authorities in December, 1917, and by a majority of two to one (each authority having equal voting power) the local authorities refused to consider the latter portion of the engineers' scheme dealing with the purchase of existing stations and the erection of new stations.

The decision was, he thought, unfortunate. Had it been otherwise, Lancashire would have had the opportunity of setting an example to the rest of the country by carrying out proposals, which were, in all essentials, identical with the main proposals in the Electricity Bill now before Parliament. But the work of the Linking-up Committee was not altogether fruitless. It brought the question prominently before local authorities and engineers, and linking-up committees became the fashion throughout the country. A number of instances of voluntary linking-up had taken place, some of them in Lancashire. Perhaps the most interesting of these was the recent linking-up of Manchester and Salford. A cable had been laid of 10,000 kw. capacity at 33,000 volts between the Moss Side sub-station of Manchester Corporation and the Salford generating station in Frederick Road. The energy was stepped up from 6,600 to 33,000 volts at Moss Side, and stepped down again at Frederick Road to 6,600 volts, where the two systems were operated in parallel. In the meantime provision was made for a supply of 5,000 kw. by Manchester to Salford, but this could be increased to the full capacity of the cable by installing a second set of transformers. The Salford system, in addition to operating in parallel with Manchester, also operated in parallel with the system of the Lancashire Power Co., which was connected to two generating stations each generating at 6,600 volts, so that they had a series of five linked-up stations extending from Manchester in the east to Wigan in the west.

Following the reports of the Lancashire Committee, the Committee on Power Supply appointed by the Board of Trade issued its report in June of last year, and as a result the Electricity (Supply) Bill was now before Parliament, and was bound to exercise an enormous influence on future developments. The most striking feature of the Bill was the enormous powers which were to be exercised by the five commissioners. So far the only commissioner appointed was the chairman-designate, and it would be a source of satisfaction to power station engineers that the choice had fallen upon Sir John Snell, who was not only an engineer of great ability and wide experience, but who possessed to an exceptional degree the confidence of all parties—municipal and company—who were interested in electricity supply. The critics of the purchase terms in the case of local authorities contended that owing to the operation of sinking funds and the increase in values, the generating stations of local authorities were worth considerably more than the standard price, under either of the alternatives offered. The Joint Boards or District Boards would make a very good bargain indeed, but it must be remembered that local authorities were not, strictly speaking, trading for profit. Their proper function as a public authority was to ensure that a cheap and efficient supply of electricity was available for the community. The changes proposed in the Bill simply meant the transfer of their responsibilities and liabilities to the new authority, and they would reap the benefit of cheap purchase of their station by the District Board in the reduced rates charged to them for bulk supplies. In the case of companies the conditions were somewhat different. They had invested their shareholders' money in providing electricity supply under Parliamentary sanction, and it would be contrary to all our traditions to take their generating stations from them now on terms less favourable than they were entitled to under existing Acts of Parliament. It was unfortunate that a compromise satisfactory to the companies could not be arrived at. If the companies lost their generating stations, and wished, as many of them would, also to dispose of their distribution systems, they would receive the original value of the whole undertaking, including the station, without any deduction for depreciation. The provisions of Clauses 7 and 12 as they stood appeared to be designed to drive private companies out of the business of electricity supply. The provision in Clause 7, sub-section 5, that when a generating station had been taken over by a District Board, the board was obliged to supply the authority from whom it was taken with electricity not less in amount than could have been generated at the transferred station, and at a price not greater than that at which it could have been generated, simply bristled with difficulties, and struck a blow at the main purpose for which the Bill had been drafted. The anomaly at the present time in nearly all industrial districts was the difference in prices and rates charged by the various supply authorities. Under sub-section 5 the anomaly was to be continued in perpetuity. He trusted that the sub-section would be deleted, and that the district boards would be obliged to supply energy to the distributing authorities over the whole of the respective electricity districts at uniform rates. Under Clause 16 of the Bill the principle of public control had been established in cases where schemes were financed with public money. In Clause 17 the compensation terms for deprivation of employment had been enlarged, and would now, he thought, be

accepted as generally satisfactory by those interested. It was gratifying to note that the commissioners would have power to make experiments with the object of improving the supply of electricity. There was still much investigation required regarding the properties of insulating materials for high-pressure cables and generating plant, the corrosion of turbine blading, protective devices for high-tension systems, switchgear to deal with pressures up to 50,000 volts, and many similar problems. It was likely that within the next five years a sum of not less than one hundred millions would be expended in the construction of new stations and transmission lines, and a small fraction of this amount, say, a quarter of one per cent. expended immediately on research work, would prove a thoroughly sound investment.

It appeared likely that the Lancashire and Cheshire area would be one of the first to be dealt with, and the question was: Would the local authorities be able to sink local jealousies and co-operate with each other and with companies for the purpose of a joint scheme? It was to be hoped that on this occasion, and having in view the fact that if they failed to agree on a voluntary scheme a District Board would be set up in which they would be compelled to take part, they would take a broad view, uninfluenced by personal or local considerations. With regard to the merits of local generating stations situated near the centre of their respective loads, as compared with supply from one large station on a site suitable for economical generation, but distant by comparison from the loads, at the present time engineers were more divided amongst themselves as to the policy to be followed than they were a few years ago. It might be admitted at once that in the case of a local station, equipped with fairly modern plant at the prices obtaining prior to 1917, with natural condensing facilities sufficient to deal with the present load, and able to operate economically sets of 3,000 or 5,000 KW. capacity, it was extremely difficult to make out a case for supply from a superstation, say, 8 or 10 miles distant. There were a number of such stations in the Lancashire area which could show working costs that compared favourably with many of the larger stations now in operation. On commercial grounds there appeared to be no good reason for closing down these stations at present in favour of a bulk supply. In preparing a scheme for a whole district, however, regard must be had not to present conditions, but to the conditions which might exist seven or ten years hence. They were faced in these industrial districts with very much greater demands for electricity than they had been accustomed to in the past. The enormous increase during the war would be more than maintained, they had already regained the position of November, 1918, and further demands were constantly being made. It was not too much to estimate that within the next five years the present output would be at least doubled, and if the national scheme fulfilled expectations, still greater increases might be looked for. The erection of a new station, other than a superstation, in the industrial areas, was unthinkable, unless under most exceptional conditions. In the case of a district with ten or twelve local stations of varying capacity, it was probable that in three-fourths of the stations a bulk supply from a superstation, favourably situated, would show an advantage, while in the other two or three stations a case could be made out for local generation. If, however, a new superstation was required for the district, it might be good policy to close down the two or three efficient stations in addition to the eight or nine inefficient stations, to increase the load factor on the superstation, and so improve the supply to the whole district. The two or three efficient stations in the group would be interconnected, and could be retained for standby or peak-load purposes up to the limit of their economical capacity. The supply of electricity could not be considered by itself alone. The electrification of railways was certain to develop enormously in the near future. It was of the greatest importance that the two supplies should be combined, and the question of centralised generation *versus* local station, might in many cases be determined by this factor alone. Another question that could not be overlooked was the tendency for cities and towns to spread out in order to find improved housing accommodation for the workers, and the advantage of the local station to-day through its proximity to the load might be a diminishing factor in the future. There remained the deciding factor of fuel conservation. A cheap and abundant supply of power could not be considered apart from this question. In passing, reference must be made to the repeated claims made by the gas authorities on behalf of coal carbonisation as a means to effect fuel economy. On this question power station engineers had an open mind. The urgent and primary need was for a supply of cheap power, and if this object could be more economically achieved by a process of carbonisation, it would be welcomed by the electricity supply industry. The gas engine was quite unsuited to power production on a large scale, while the distribution of gas over a large area for power purposes was not a practical proposition. The combination of coal carbonisation with the production of power was a question on which further information was urgently required. The powers of the Electricity Commissioners would enable them to conduct experiments on the utilisation of fuel, and it was probable that some of the new stations to be erected would employ to a limited extent carbonisation plant, with the object of gaining information and experience. In the meantime it appeared certain that under the new power schemes, the great bulk of power production would be obtained from stations with coal-fired boilers and turbine-driven generators, showing a boiler house efficiency of 80 to 85 per cent., and an overall thermal efficiency of 18 to 20 per cent. Useful information was available from the Coal Mines Department, which had summarised the monthly returns of power-station fuel consumptions in the United Kingdom for the years 1918 and 1919. The summary included returns from 438 electricity undertakings having an output of 4,745,000,000 units, and a total fuel consumption of 7,356,000 tons, including 31,000 tons of coke. The stations were grouped in four classes, viz.:—

(*a*) Stations having an output of over 50 million units per annum.

(*b*) Stations having an output of between 15 million and 30 million units per annum.

(*c*) Stations having an output of between 3 million and 15 million units per annum, and

(*d*) Stations having an output under 3 million units per annum.

The average fuel consumption of all the stations was 3.47 lb. per unit generated for the year ended March, 1919. In group (*a*) the lowest fuel consumption of any station was 1.8 lb. per unit, representing a thermal efficiency of 18 per cent., the average being 2.76 lb. per unit, and the highest for any station 3.95 lb. per unit. In group (*b*) the lowest fuel consumption of any station was 2.19 lb. per unit, representing a thermal efficiency of 14 per cent., the average being 3.39 lb. per unit, and the highest, 6.75 lb. per unit. In group (*c*) the lowest fuel consumption of any station was 2.61 lb. per unit, representing a thermal efficiency of 11.2 per cent., the average being 4.34 lb. per unit, and the highest 11.47 lb. per unit. In group (*d*), the small stations, the lowest fuel consumption was 3.72 lb. per unit, representing a thermal efficiency of 7.2 per cent., the average being 6.95 lb., and the highest 63.25 lb. per unit. The latter was probably a freak figure from a small station operating under abnormal conditions. Now, if the whole of the energy produced by the 438 stations had been generated as economically as it was at the station with the lowest consumption in group (*a*), *i.e.*, with 18 per cent. thermal efficiency, the resultant saving would have been fully 3½ million tons, or 47 per cent. of the total consumption. A possible saving of three million tons per annum, if capitalised at the present price of coal on a 20 years' basis, would amount to no less than £90,000,000. This saving was calculated on the present output of electricity. Taking into account the certain growth in output, which could not be estimated at less than double the present output five years hence, the saving of our capital resources would be correspondingly greater. It was not sufficient therefore for the local station engineer to show that a case could be made out for continuance on commercial grounds. The question must be looked at from a much broader point of view. Transmission systems consisted chiefly of materials with an indefinitely long life and considerable residual value. The wastage of coal, on the other hand, could never be recovered, and in wasting it they destroyed at once the nation's capital and their greatest industrial asset. The outlook for the electrical industry as a whole was never more promising than to-day. The rapid development during the war, the application of electricity to many industrial purposes, such as steel smelting and chemical processes, which were only in the speculative stage a few years ago, had established the future of the industry on a thoroughly sound basis. The manufacturers of electrical plant and apparatus had an unrivalled opportunity. The whole world was waiting for their productions. The problem of the moment was to increase production, so as to meet the needs of their own markets in the first place, and at the same time to re-establish their export trade, to enable them to pay off the heavy indebtedness arising from the war. There was no public body in the country to-day which wished to place its contracts in any country but their own. But if the purchaser was to lose the protection afforded by foreign competition, he must have some assurance that the prices charged were fair and reasonable, having regard to industrial conditions in this country, and that the plant he was purchasing would be at least equal in design and performance to the best that could be obtained abroad. A sub-committee of the Centre had been recently formed with the object of bringing together the technical college authorities, manufacturers, and power-station engineers, with a view to providing a specialised training—technical and practical—for the young engineers intending to follow power-station work. The District Boards and the supply authorities must remember, however, that if the right kind of men were to be attracted, the salaries paid must be adequate for the training they had received, and the responsibilities they had to undertake.

Service Notes.—A new Royal Warrant states that chief instructors at the Schools of Electric Lighting will now draw pay at the rate of £2 17s. 6d. with Class 5 allowances, and instructors at the same school will draw at the rate of £1 16s., with Class 9 allowances.

Lieutenant W. D. Elwin, Cornwall Fortress Engineers (Electric Lights Company), has relinquished the acting rank of captain.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Horophone.

Among the many applications of electricity to horology produced by the Synchronome Co., Ltd., 32, Clerkenwell Road, E.C. 1, our readers will recollect the "Horophone," designed in pre-war days to receive the wireless time signals transmitted from the Eiffel Tower at Paris. This has now been altogether remodelled in the light of wartime advances in the science of radiotelegraphy. The new type makes use of "variometer" tuning, thus dispensing with sliders and inefficient contacts, and leaving but one adjustment necessary to receive the time signals.

It will be seen from the illustration, fig. 1, that the necessary instruments are contained in a hard-wood box, the double headgear telephones being in a compartment on the left. There is a switch on the underside of the lid so arranged that, on closing it, the aerial is connected to earth, thereby securing protection from lightning.

On opening the box, the programme of Paris time signals is revealed, together with their codes clearly represented by means of two spiral diagrams. The signals are transmitted at 10 o'clock and 10.49 in the morning, and at 11.30 and 11.49 at night. It may not be generally known that this service has been carried on throughout the war. Its accuracy is unquestioned.

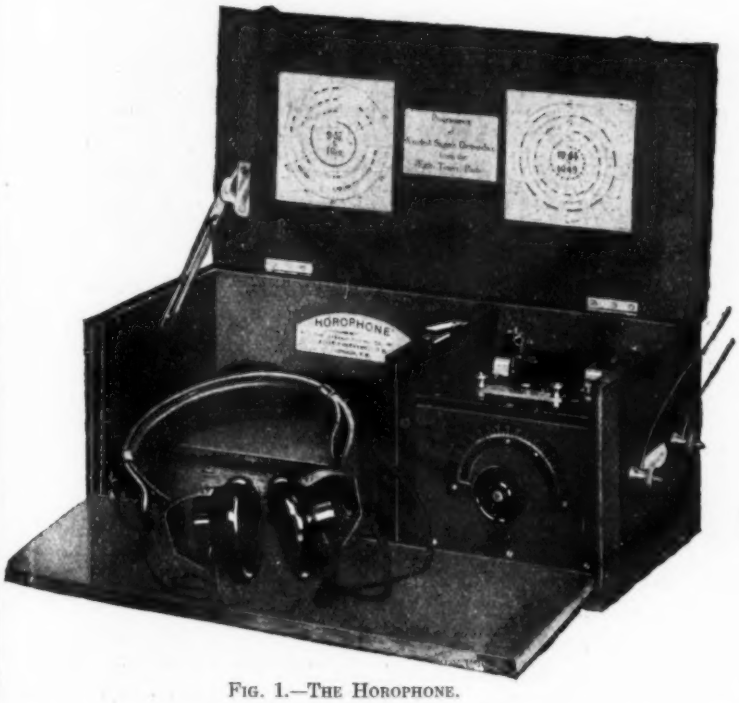


Fig. 1.—The Horophone.

For those who wish to listen to other transmitting stations and the shipping round our coasts, a small addition is provided called a short-wave switch; but the object of the designers has been to avoid complications, and to provide a simple instrument for the non-technical which will not readily get out of order, and will enable the Paris time signals to be easily heard on quite a small aerial.

A Concrete Telephone Booth.

A novel reinforced concrete structure made by the Cement Gun Construction Co., Chicago, is described in *Electric Traction*. It is constructed in three parts—base, barrel and roof—and a wooden shelf is provided for the instruments, whilst bushings are made in the side through which to run the connecting wires. In order to protect the telephone from high voltages, the circuit is broken when the door is locked and automatically made when the door is unlocked. On the concrete floor a light insulated wooden floor is fixed so as to ensure perfect insulation. The device is illustrated in fig. 2.

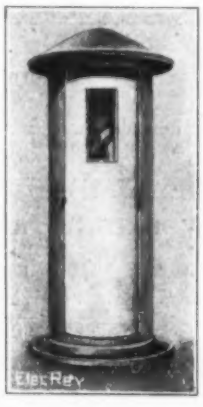


Fig. 2.—Concrete Telephone Booth.

The Victory Magneto.

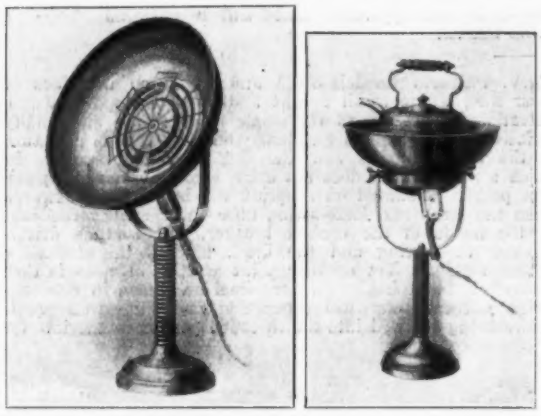
At the recent Olympia Motor-cycle Show, Messrs. C. A. Vandervell & Co., Ltd., Acton, London, W. 3, exhibited new models of their light-weight magnetos running at varying speeds as when in actual use, and also electric lighting sets for motor cycles. The two new models K.U.1 and K.U.2, fig. 3, have been designed to replace the original C.A.V. magneto (models 3.U.1 and 3.U.2) on machines of lower h.p., where small weight and size are important considerations. They are of the single magnet type and totally enclosed. These machines embody the same type of armature as the larger models and the C.A.V. contact-breaker, in which a rocking arm does not exist, since the movable platinum point is mounted on a spring which is forced outwards when the large and loose-fitting fibre roller strikes the cam on the inside of the contact breaker, and is thus driven between the spring and the block holding the stationary platinum point. Yet another point worthy of note is that the carbon brush-holder and terminal are made in one, ensuring a secure electrical connection and quite waterproof. Before being screwed into the threaded portion in the interior of the terminal, the high-tension wire is bared and unravelled for about half-an-inch and the ends are turned back over the insulation. These magnetos do not require oiling. The armature runs on ball bearings filled with a special grease, which will last about a year, taking an average of 5,000 miles running. To refill the ball races with this, it is necessary to remove only the bearing-box covers, before doing which the contact-breaker sleeve and contact breaker must be removed from the rear, and the carbon brush-holder unscrewed from the front bearing-box cover. Both covers can then be easily removed after taking out the holding screws. The new magneto is presented in two types, viz., for single-cylinder engines up to about 3 h.p., and for horizontally opposed twins of the same power. The principal features of previous C.A.V. models are incorporated, including the contact breaker which works without a rocker arm. All working parts are entirely protected from dust, mud, &c. These magnetos can, it is claimed, be immersed in water, and will even then work perfectly. The lighting dynamo, although primarily intended for small cars, has been found to be well suited for motor cycle work, and owing to the advantage of its being able to run at engine speed, complicated gearing is done away with. The usual method of driving the dynamo is by means of a pulley on the engine shaft, which takes the place of the fixing nut.

Fig. 3.—C.A.V. Light-weight Magneto.

The "Creda" Fire.

The Creda pedestal fire, manufactured by Messrs. Credenda Conduits Co., Ltd., Chester Street, Aston, Birmingham, is a handy portable heater which only consumes 600 watts, and can be safely fed from a lighting circuit. The adjustable

copper reflector is arranged to focus the heat in any required direction. It can also be used for heating water, milk, &c.



Figs. 4 and 5.—Creda Fire, in two positions.

It is handsomely finished in antique copper with polished reflector and ebonised wooden grip, as shown in figs. 4 and 5.

NEW PATENTS APPLIED FOR, 1919.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

29,186. "Method of controlling electric motors operating pressure pumps, &c." H. P. H. Anderson. November 24th.

29,207. "Manufacture of filaments for electric lamps." H. V. A. Briscoe, J. C. Cunningham, and Curtiss & Harvey. November 24th.

29,253. "Electric motors." H. E. Dakin, Ltd., and F. H. Norris. November 24th.

29,273. "Sparking plugs." C. H. Haight. November 24th.

29,276. "Electric arc lamp resistance kinematographs, &c." G. K. Jensen. November 24th.

29,280. "Conductor rails for electric railways, &c." Merz & McLellan and S. G. Redman. November 24th.

29,284. "System of automatic interrupters for electric circuits." A. M. Jane. November 24th. (Spain, March 29th, 1916.)

29,296. "Wireless receiving apparatus." C. K. Chandler. November 24th.

29,300. "Incandescent welding with electricity." F. G. Gale. November 24th.

29,307. "Sparking plugs." A. A. Becker. November 24th.

29,322. "Telegraphy." E. S. Heurtley and Muirhead & Co. November 25th.

29,336. "Electrically-heated articles." G. Turnock. November 25th.

29,339. "Electric ignition, collecting, distributing and timing devices and systems." G. M. Turner. November 25th.

29,392. "Wireless signalling systems." British Thomson-Houston Co. (General Electric Co.) November 25th.

29,395. "Magneto-electric machines." E. A. Watson. November 25th.

29,404. "Electric switches." V. E. Joyce and Park Royal Engineering Works. November 25th.

29,407. "Surgical attachment for electric torch." M. H. Dutch. November 25th.

29,414. "Electric furnaces." A. M. Ericksen. November 25th.

29,446. "Terminal electrical connections for sparking plugs." M. L. Williams. November 26th.

29,448. "Filament for electric glow lamps." W. Cox and P. G. Palmer. November 26th.

29,453. "Switchgear for electric motors." P. S. Brook and J. A. Hirst. November 26th.

29,468. "Induction coils." A. W. Sharman. November 26th.

29,473. "Electrically-heated flat irons." V. S. Needham. November 26th.

29,480. "Heating, ventilating, and vaporising apparatus using gas, electricity, &c." F. Hewett. November 26th.

29,481. "Electric fire and burglar alarm systems." H. J. Andrews and R. Say. November 26th.

29,515. "Electric stoves." Soc. Anon. dite Calor. November 26th. (France, November 29th, 1918.)

29,521. "Electric switches." W. F. M. Rose. November 26th.

29,523. "Automatic switching mechanism for telephone, &c., systems." Automatic Telephone Manufacturing Co. (Automatic Electric Co.) November 26th.

29,526. "Separator for storage batteries." A. O. Tate. November 26th. (United States, March 8th.)

29,527. "Dynamo-electric machines." L. J. Stephenson. November 26th. (United States, October 10th, 1918.)

29,528. "Dynamo-electric machines." L. J. Stephenson. November 26th. (United States, May 15th.)

29,531. "Combined motor-car bonnet lock and magneto switch." P. E. Monkhouse. November 26th.

29,532. "Sparking plugs." Marmon Chicago Co. November 26th. (United States, December 16th, 1918.)

29,538. "Electrically-driven motor vehicles." A. Decorat. November 26th. (France, November 27th, 1918.)

29,547. "Electric condensers." W. E. Barber. November 27th.

29,561. "Electrically-heated soldering-iron." W. H. Browning. November 27th.

29,585. "Dynamo-electric machinery." M. Walker. November 27th.

29,617. "Signalling circuits." Western Electric Co. (Western Electric Co.) November 27th.

29,626. "Electric and other light fittings." A. Hardie and H. R. Hardie. November 27th.

29,672. "Magneto motors." D. Suchostawer. November 28th.

29,673. "Dynamo-electric machines." D. Suchostawer. November 28th.

29,683. "Electric motors." T. Zwergborck. November 28th.

29,690. "Electric relays." W. H. Grinsted and E. A. Pitithory and Siemens Bros. & Co. November 28th.

29,691. "Electric bell pushes or contact makers." R. S. McLaren. November 28th.

29,706. "Arc lamps for searchlights or projectors." C. B. Burdon. (Siemens-Schuckertwerke.) November 28th.

29,719. "Sparking plugs." H. O. Cooper. November 28th.

29,722. "Reflectors for electric light fittings." H. G. Sproates. November 28th.

29,723. "Electric discharge apparatus." Western Electric Co. (Western Electric Co.) November 28th.

29,740. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co. November 28th. (United States, March 13th.)

29,746. "Electrical heating apparatus." A. Verdini. November 28th.

29,772. "Electric connector plate for ceiling-roses, &c." S. S. Bird. November 29th.

29,783. "Insulating and anchoring device for electric lamp holders, &c." B. Deakin. November 29th.

29,801. "Process for manufacture of metallic plates by electro-deposition." S. O. Cowper-Coles. November 29th.

29,813. "Telephone systems." Automatic Telephone Manufacturing Co. and G. W. Flynn. November 29th.

29,816. "Electrically-actuated mechanism for producing sliding or rotary motion." E. N. Bray. November 29th.

29,820. "Controlling mechanism for electric circuits." British Thomson-Houston Co. (General Electric Co.) November 29th.

29,826. "Electric control gear for dynamo-electric machines." R. H. Barbour and J. R. Walton. November 29th.

29,836. "Electric tramway cars." D. R. Drummond. November 29th.

29,847. "Process for obtaining hard springy copper by electro-deposition." S. O. Cowper-Coles. November 29th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1918.

16,138. Wireless signalling systems. British Thomson-Houston Co. (General Electric Co.) October 4th, 1918. (134,585.)

17,504. Electric switches especially suitable for use in wireless signalling. M. D. Scott and P. P. Eckersley. October 26th, 1918. (Cognate application 18,070/18.) (134,590.)

18,051. Dynamo-electric machines. H. F. Joel. November 4th, 1918. (134,609.)

18,108. Aeronautical dynamos. G. E. Mortley. November 5th, 1918. (134,614.)

18,209. Dynamo-electric machines. P. A. H. Mossay and Enclosed Motor Co. November 6th, 1918. (134,620.)

18,233. Apparatus for transmitting and indicating signals and the like. J. D. Lynch. November 7th, 1918. (134,621.)

18,500. Electric heaters. A. H. Green. November 12th, 1918. (134,632.)

18,502. Adapter or connector for electric wires. V. E. Joyce and Park Royal Engineering Works. November 12th, 1918. (134,633.)

18,514. Sound-producers applicable to submarine signalling and the like. T. G. Wrightson and J. M. Ringquist and Head, Wrightson & Co. November 12th, 1918. (Patent of addition not granted.) (134,634.)

18,661. Electric heating devices. H. H. Berry and J. W. Reid. November 14th, 1918. (134,639.)

18,669. Chairs for the electro-magnetic treatment of the human body. J. Krauer. November 14th, 1918. (134,640.)

18,745. Electrically-operated diaphragm vibrators, particularly applicable for signalling devices in factories and like places. C. B. Harlow. November 21st, 1917. (120,914.)

19,195. System of wireless direction finding. N. P. Hinton and Radio Communiaticon Co. November 22nd, 1918. (Cognate application No. 12,373/19.) (134,644.)

19,399. Electric incandescent lamps. H. Ozaki. November 25th, 1918. (134,648.)

20,773. Optophones. A. Barr, W. Stroud and E. E. F'D. Albe. December 13th, 1918. (134,675.)

21,309. High-tension insulators. H. Wade. (Fabbrica Isolatori Livorno.) December 19th, 1918. (134,680.)

21,766. Electric ignition apparatus for internal-combustion engines. J. Beavan. December 30th, 1918. (134,689.)

1919.

93. Fire-bar or heating element deriving its heating ability from electrical energy. H. Summers, W. D. Summers and L. Summers. January 2nd, 1919. (134,691.)

2,438. Method of driving magneto on internal-combustion engines. G. J. Rackham. January 31st, 1919. (134,712.)

3,664. Sparking plugs. W. W. Simpson. February 14th, 1919. (134,723.)

4,286. Method of and apparatus for controlling electrical energy in signalling systems and the like. C. D. Ehret. February 20th, 1919. (134,725.)

6,125. Magneto generators. M. H. Goldstone and H. O. Farrell. March 12th, 1919. (134,739.)

10,140. Pull socket electric switches. E. H. van Loon. April 23rd, 1919. (134,760.)

13,739. Telephone and telegraph systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co.) May 30th, 1919. (134,780.)

14,225. Automatic or semi-automatic telephone systems. Automatic Telephone Manufacturing Co. October 23rd, 1918. (134,193.)

19,724. Cable outlets of magneto-electric ignition machines for internal-combustion engines. Scintilla. October 1st, 1918. (133,291.)

21,392. Railway traffic controlling systems. McKenzie, Holland and Westinghouse Power Signal Co. March 4th, 1918. (Divided application on 5,270/19.) (131,923.)

25,756. Electric switches. J. B. Tucker and J. A. Crabtree. October 3rd, 1918. (Divided application on 16,054/18.) (134,809.)

Neon Gas.—In *Nature*, Mr. F. W. Aston announces the discovery that atmospheric neon consists of a mixture of two isotopes of atomic weights 20 and 22. The discovery was made by the use of a new method of positive-ray analysis.